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DISEASES DUE TO PROTOZOAN PARASITES.

ROSENTHAL (F.). **Beiträge zur Immunität bei Trypanosomeninfektionen. Ueber den Mechanismus der chemotherapeutischen Heilung.** [Immunity in Trypanosomiasis. The Mechanism of Chemotherapeutic Action.]—*Ztschr. f. Immunitatsf. u. experim. Therap.* I. Teil. Orig. 1918. July 20. Vol. 27. No. 4. pp. 287-304. With 4 tables.

The curative effect of a drug does not depend entirely upon its affinity for the parasite cells but also upon the complex relationships existing between it and the host's body. To commence with, one endeavours to ascertain the sensitiveness of the body cells of the host towards the activity of the drug and the toxic effect of this substance upon the infective organisms. The chemotherapeutic effect of the drug would correspond with the degree to which the parasite-destroying properties of the drug exceeds its organ-destroying property. This biological formula, as laid down by EHRLICH, does not, however, furnish an exhaustive explanation of all the complex phenomena of chemotherapy. MORGENROTH and HALBERSTÄDTER showed that this view only took into account the combinative powers of the cells for the poison and not their sensitiveness and no light was given on the distribution of the chemotherapeutic action by chemical tests; moreover, no account is taken of the rate of absorption and elimination of the drug. As a rule the longer the product remains at its optimum concentration in the circulation and tissue juices the greater will be its effect upon the infecting organisms.

The therapeutic effects brought about by the injection of the drug are also not exhausted by simple destruction of the parasites. As in the case of vaccination with dead or attenuated viruses the production of specific protective bodies is brought about. The role of these substances in the recovery of the affected animal was demonstrated in EHRLICH'S original researches; this author pointed out that the curative effect of a drug became accomplished through the simultaneous action of specific trypanocidal antibodies. The presence of these bodies can be demonstrated in trypanosome-infected mice within two or three days after the administration of a curative dose of a drug, although their concurrence

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in the curative action resulting from the injection of the drug is not demonstrable from this observation. SCHILLING also found reason to believe that the trypanocidal antibodies made their appearance within a very short time after the injection of the medicament; for example, nagana-infected rats treated with a curative dose of arsenophenylglycine showed immunity against super-infection in 24 hours, and further a nagana-infected rabbit even proved immune within three hours after intravenous injection of the same drug (SCHILLING and JAFFE). The prolonged prophylactic action of arsenophenyl glycine cannot, however, be excluded with certainty in making deductions from these results. In all experiments hitherto performed it is thus seen that the time of onset of immune bodies in the circulation has been insufficiently determined.

The experiments performed by the author were carried out with the object of determining whether the specific trypanocidal substances followed rapidly after the commencement of the chemotherapeutic action or made their appearance after the pharmacological action had come to an end, i.e., whether there existed a latent phase separating the formation of antibodies from the period of drug action or whether these antibodies exercised an appreciable effect in the process of recovery towards the later stage in the action of the drug.

In the experiments performed with this object in view the author employed trypanosome-infected mice which were given subcutaneously a curative dose of tartar emetic at the height of infection and then at various intervals injected intravenously with a rich emulsion of living trypanosomes. The author and MORGENROTH had previously shown that tartar emetic was capable of causing the disappearance of trypanosomes from the blood within three hours after injection and that the protective effect of this injection against subsequent severe intravenous infection was just appreciable after ten minutes, hardly appreciable after one hour, and altogether absent within two to three hours after administration of the medicament. This drug was thus much more suitable for the experiments than such products as arsacetin and arsenophenylglycine. Further experiments were made in which it was proved that although tartar emetic exercised such powerful curative effects it had scarcely any appreciable prophylactic action and, finally, the effects of neutralising the action of tartar emetic within the body by administering intravenously its antidote, potassium hexatantalate, simultaneously and also at intervals of a few minutes were tested.

Briefly the author's conclusions are as follows:—

"Trypanocidal immune bodies make their appearance even within the first hour of the commencement of the chemotherapeutic treatment and take an immediate active part in the recovery. Their early appearance is manifested:

"(1) Directly: by the method of early intravenous infection of newly recovered trypanosome-infected mice. The utility of the method obviously depends upon the employment of a chemotherapeutic agent which exhibits a markedly transitory prophylactic action such as, for example, tartar emetic.

"(2) Indirectly: (a) by the paradoxial divergence in the chemotherapeutic action of tartar emetic in prophylactic and curative tests;

"(b) by the uninterrupted recovery in cases of trypanosomiasis treated by means of tartar emetic even when the antimony action is eliminated at an early stage through the action of potassium hexatantalate."

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PEARCE (Louise) & BROWN (Wade H.). **Experimental Trypanosomiasis. Its Application in Chemotherapeutic Investigations.**—*Jl. Experim. Med.* 1918. Aug. 1. Vol. 28. No. 2. pp. 109–147. With 8 tables and 13 plates, comprising 30 figs.

In this article the authors state that "although experimental trypanosomiasis has been the subject of countless contributions to the literature, comparatively little has been written, regarding the biological principles involved in the adaptation of the experimental infection to chemotherapeutic investigations." A brief account of the history of the drug treatment of experimental trypanosomiasis by various workers is given. In these investigations mice appear to have been more extensively used than any other animals and the infecting organism most commonly employed has been *Trypanosoma brucei*. Next in frequency have come rats, while rabbits, guinea-pigs, and other animals have been used in small numbers and largely to supplement rat and other experiments. The methods hitherto adopted appear to the authors to lack co-ordination. The essential requirements of workers are a means of determining quickly and accurately the activity of substances upon an infecting organism and a means of determining the curative powers of these substances, which may be problems of an entirely different character. The solution of these problems can best be approached through a careful analysis of the various forms of trypanosomiases, including both the animals and organisms utilised, the means of propagating and regulating the infection, and finally, the general response of various species of trypanosomes to therapeutic agents.

The methods of propagating laboratory strains of trypanosomes in experimentally infected animals are next indicated. Continuous direct passage from animal to animal of the same species is desirable in order to obtain uniformity of infection reactions where the organisms are to be used for therapeutic experiments. Blood from animals at the height of infection is diluted with an isotonic salt solution so that a certain volume used for inoculation always contains approximately the same number of active trypanosomes. In their laboratory the authors inoculated mice, rats, and guinea-pigs intraperitoneally with a comparatively small number of *T. brucei*, *equiperdum*, and *evansi* and about double that number of *T. gambiense* and *equinum*. Rabbits were infected intravenously also with a small quantity of the first named three trypanosomes and a much larger quantity of the other two strains. Mice or rats to be used for therapeutic experiments are inoculated from a stock strain carried in mice or rats, while guinea-pigs and rabbits may be inoculated from a guinea-pig stock; the transmission of the trypanosomes is carried out in this way on account of the fact that the organisms bring about a rapidly fatal termination in the case of mice and rats while guinea-pigs and rabbits exhibit a chronic cyclic infection.

The authors then detail at some length their clinical and post mortem observations in connection with the transmission of the above-named five strains through the ordinary laboratory animals. In the tables are summarily indicated the hitherto published results of other investigators. The clinical study then given at some length by Pearce and Brown does not add very materially to the already

existing knowledge on this subject. After discussing the principles of adaptation and utilisation of the various strains of trypanosomes and laboratory animals for chemotherapeutic investigations they conclude their paper as follows :—

"Treatment of experimental trypanosomiasis of mice and rats is largely a matter of speed and action. Since these animals are easily procurable and the results of treatment are quickly seen, the chemotherapist has in this type of infection a valuable experimental test for the quick determination of the therapeutic activity of a compound. For all preliminary routine work, especially if a large number of compounds are to be tested, the utilization of mouse and rat infections gives definite and valuable information in a relatively short space of time. On the other hand, since experimental trypanosomiasis of guinea-pigs and rabbits is predominantly a chronic tissue infection more nearly analogous to the naturally acquired forms of the disease, the factor of ultimate curative power or potency of a compound, rather than its immediate trypanocidal action, is emphasized in the treatment of such infections. From the point of view of the chemotherapist, the two types of infections supplement each other and the proper utilization and adaptation of each type constitute a logical basis for procedure in the chemotherapy of experimental trypanosomiasis."

CITRON (H.). **Ueber die Einwirkung des Mesothoriums auf Trypanosomen.** [The Action of Mesothorium on Trypanosomes.]—*Ztschr. f. Immunitatsf. u. Experim. Therap.* I. Orig. 1918. Aug. 17. Vol. 27. No. 5. pp. 369–373.

No sterilisation is produced by submitting trypanosomes to the action of γ-rays, even for several hours; the only change brought about in the organisms is to cause them to set up an infection of lessened severity in inoculated animals, with the ultimate result that such animals succumb later than controls. The substance necessary for prolonging the viability of the trypanosomes passes easily through a dialyser.

HARTMANN (M.) & NOELLER (W.). **Untersuchungen über die Cytologie von *Trypanosoma theileri*.** [Investigations on the Cytology of *Trypanosoma theileri*.]—*Arch. f. Protistenk.* 1918. Apr. 27. Vol. 38. No. 3. pp. 355–375. With 2 plates & 6 figs.

In this article the authors take the non-pathogenic cattle trypanosome, *T. theileri*, for their studies in connection with the morphology and method of division of the various structures composing a trypanosome cell, on account of its comparatively large size and the ease with which it can be cultivated on laboratory media [see this *Bulletin*, 1917, Vol. 5, No. 3, pp. 166–171]. A comparison is made with the processes occurring in *T. noctuae*, *lewisi*, *brucei*, *dimorphon*, and *Schizotrypanum cruzi*. The article is illustrated with a number of beautiful figures. The authors' conclusions to a somewhat highly technical discussion are as follows :—In *T. theileri* the blepharoplast and basal granule divide separately and the old flagellum remains connected with one of the daughter basal granules whilst from the other basal granule a new flagellum is formed.

Woods (Alan C.) & de Schweinitz (George E.). **Trypanosome Keratitis —An Experimental Study.**—*Arch. of Ophthal.*, New Rochelle. 1917. Sept. Vol. 46. No. 5. pp. 431–445. With 1 plate.

The authors first give an interesting summary of previous work done in connection with the nature of the ocular changes in trypanosomiasis. There appears to be some dispute as to whether the keratitis is produced by the presence of the trypanosomes themselves or by the action of the toxin secreted by these organisms remote from the seat of injury. In the observations recorded in this paper dogs infected intravenously with *T. equiperdum* were used. The following is the authors' summary :—

"Ocular lesions occur constantly in dogs infected with the Trypanosoma equiperdum. These lesions are manifested clinically as a dense clouding of the cornea and an iritis with hemorrhages and exudates in the anterior chamber, with the occurrence of pericorneal injection and photophobia. The lesions are not caused by a general toxaemia, but occur synchronously with an actual invasion of the ocular humors by the trypanosome, and appear to be dependent upon the invasion of the ocular humors and the ocular tissues by the parasites. The ocular lesions are readily cured by repeated injections of arsenobenzol, the American reproduction of salvarsan.

"Pathologically, the corneal lesions are those of an interstitial keratitis with an actual invasion of the substantia propria by the trypanosomes. The lesions of the iris consist in a marked oedema of that tissue, with a rather dense cellular infiltration of mononuclear and polynuclear cells. The ciliary processes are themselves uninvolved, but occasionally they are embedded in a serofibrinous cellular exudate in which occasional trypanosomes are found. The retinal lesions consist of focal lesions characterized by a disarrangement of the retinal layers with a monocellular infiltration. Over these areas is a cellular exudate containing trypanosomes."

Blumenthal (Franz). **Ueber die Wirkung von Rontgenstrahlen auf *Trypanosoma Brucei*.** [On the Action of Rontgen Rays on *T. brucei*.]—*Berlin. Klin. Woch.* 1917. Sept. 17. Vol. 54. No. 38. pp. 918–920.

In the first part of his paper the author deals with the literature on the above subject and then records his own experiments in which mice infected with *T. brucei* were submitted to the action of Rontgen rays. It was found that no noteworthy effect was produced upon the organisms in the living animal. As the result of enormous doses of the rays, however, there was a delay in the development of the infection, but in such cases the injury to the body of the host was so great that the mouse often died before trypanosomes could be observed in the blood. If the animal survived the first few days, however, trypanosomes appeared in the blood. The delay in the appearance of the organisms was more probably due to the severe blood changes caused by the action of the rays than to direct action upon the parasites. Experiments with suspensions of living trypanosomes diluted in normal saline solution *in vitro* also failed to demonstrate any noteworthy changes as the result of the action of the rays.

Stevenson (A. C.). **The Presence of Trypanosomes in Brain Substance. Preliminary Note.**—*Jl. Trop. Med. & Hyg.* 1918. Jan. 15. Vol. 21. No. 2. p. 17. With 1 plate comprising 6 figs.

In this short note the author describes the occurrence of trypanosomes in the brain substance of a guinea-pig inoculated six months previously

with a strain of *T. nigeriense*. After about five and a half months from the time of inoculation the guinea-pig showed some weakness of the hind quarters which became more definite during the succeeding two weeks. Paraffin sections of the brain showed trypanosomes, many of which were dividing, scattered through all parts of the brain substance, with no special relation to the capillaries and small blood vessels. The organisms appeared to be most numerous in the mid-brain. The small-celled infiltration of the perivascular tissue, the presence of which is characteristic in human sleeping sickness, was well marked, and masses of trypanosomes were seen in the affected parts.

Another guinea-pig inoculated from the above survived only four months, dying suddenly without symptoms; sections of the brain showed a large number of trypanosomes in the blood vessels, but in the brain substance itself they were only found after prolonged search near the surface of the cerebral hemispheres. No perivascular infiltration was observed in the substance of the brain but a small amount was seen around the vessels of the pia mater. In the medulla below the floor of the fourth ventricle there were numerous capillary haemorrhages which contained numbers of trypanosomes. No Gram-staining streptococci were found in these brains as are often found in sleeping sickness brains.

The presence of trypanosomes in the brain substance itself appears to have been described only in one instance, viz., by WOLBACH and BINGER (1912) in the brain of a monkey.

VELU. **Une trypanosomiase du cheval au Maroc. Etude clinique et Expérimentale.** [A Trypanosomiasis of the Horse in Morocco. A Clinical and Experimental Study.]—*Rev. Gén. Méd. Vét.* 1918. Oct. 15. Vol. 27. No. 322. pp. 489–513.

From August 1916 to August 1917 Velu studied among the horses of a native cavalry unit at Dar-bel-hamri a trypanosomiasis transmitted probably by the bites of gadflies; it also presented special features in that it ran a characteristic clinical course, developed differently from other trypanosomiases in laboratory animals, and its causal organism was a dimorphic trypanosome. On this account the author proposes the name "Trypanosomiasis of Moroccan Horses" for the malady.

The course of the outbreak since it was first diagnosed in 1914 is outlined. During the year June 1916–1917 out of a total of 178 horses 125 had become infected, out of which 86 died. The remaining 39 sick animals had then apparently recovered and were distributed to various units.

Clinical study.—The natives believe that the disease is caused by the bites of tabanids (*el debab*), which are found in abundance in this region especially around shrubby outgrowths and bite horses during the hottest part of the day; horses are difficult to breed in this district. Inasmuch as only the more severe symptoms attract attention they believe that the disease lasts only about a week. The more chronic forms accompanied by anaemia are regarded as a different disease, *el roch*, meaning cachexia.

The period of incubation of the natural disease is difficult to determine. From observations on 12 horses the maximum duration was estimated to vary from 59 to 104 days.

The symptoms at first are ill-defined and escape attention if the animal is not closely observed. Soon afterwards the animals become dull and dejected-looking; the appetite is maintained but irregular. The animals sweat easily and become rapidly exhausted and are unable to keep up with other horses on the march. Recurrent febrile attacks are very characteristic and between these attacks the infected animal may appear quite normal. At a more advanced stage of the disease anaemia and cachexia, however, attract attention.

Each febrile attack is manifested externally by dullness, more or less intense dyspnoea, haggard appearance, petechiae, inco-ordination of movements, inappetence and fever. The first distinct febrile attacks are sometimes separated by considerable intervals—up to three months in one observation—and the affected animals might during that time be wrongly considered free from the disease. As a rule these crises are more frequent and more regular during periods of intense heat and rarer during rainy weather. The average interval between two consecutive crises varies. As a rule the temperature rises to 104·9°–105·8° F., exceptionally to 107·2° F., and the fever remains for four or five days, exceptionally up to eight days. In some cases the temperature falls within a few hours. The rise and fall of the temperature curve is very irregular, and considerable differences may be exhibited between the morning and evening temperatures, 5° F. or more. At the commencement of the disease the febrile crises are often of very short duration. In rare cases they are non-existent and the fever is more or less continuous, especially in those cases where the disease runs its course very quickly.

Stupefaction is a constant symptom during the crises; the affected animals allow themselves to become covered with flies; the muscles supporting the head and tail are relaxed.

The next sign of most constant occurrence is in connection with the locomotor system. The animal drags its hoofs on trotting, and shows unsteady gait; paresis or even paraplegia of the fore limbs may set in or even complete inco-ordination of movements; when these symptoms are acute incontinence of the urine is also observed.

Ocular symptoms are fairly constant; the conjunctiva is generally brownish in colour, sometimes distinctly jaundiced, indicating gastro-intestinal derangement. The brownish colour is sometimes masked by congestion and the conjunctiva is covered with more or less large petechiae, which are at first of a light red and finally of a dark violet colour. The eyelids are slightly oedematous. The upper layers of the conjunctiva sometimes become shed and the erosions thus produced sometimes set up a marked conjunctivitis manifested by considerable lachrymation. In very acute cases the changes in the eye may be more intense and hence the animal may shed blood-stained tears. In rare cases keratitis may be seen.

In the majority of cases there are no subcutaneous oedematous swellings in this disease. If they are present they are small, sharply circumscribed and situated especially around the fetlocks.

Cardiac symptoms are also noted; the pulse is small, rapid, thready; the heart palpitates on the slightest exertion; a very marked venous pulse is very often observable. An exudation into the pericardial sac takes place concurrently with the ocular lesions and oedematous swellings. The blood becomes watery and assumes a characteristic colour resembling "*sirop de grenadine.*"

With regard to the evolution of the disease it is stated that it often develops as a chronic progressive anaemia with intermittent febrile crises; wasting is more or less marked. If the animals are well looked after at the commencement of the disease they may present a normal appearance, but they are found to be easily exhausted on being put to work. Finally, after a number of attacks anaemia, marked cachexia and inco-ordination of movements set in just before death. The above symptoms become more and more intense during the final crises. In a small minority of cases death occurs rapidly, after a few weeks, during an acute febrile attack.

It is difficult to determine the duration of the disease; symptoms were found to persist in one animal over a whole year. The question as to whether there are any spontaneous recoveries remains unsolved.

The lesions found on post-mortem examination vary according to the type of the disease. In the chronic forms there are no characteristic lesions except those of a more or less marked anaemia. In the acute form one may observe a serous infiltration of the subcutaneous connective tissue, haemorrhages on the serous membranes and on the epicardium, and fairly abundant serous exudate in the pericardial sac (up to four litres). The heart is often hypertrophied, the liver is normal, the kidneys congested, and the spleen always enlarged.

Experimental Study.—The causal organism is a trypanosome, which is dimorphic in the horse and certain experimental animals (dog, rabbit) and monomorphic in the rat. It occurs either as somewhat long forms with free flagella or as shorter stumpy forms without free flagella or with a flagellum less than 2·5μ long along its free part; the latter forms are much less numerous than the forms with free flagella (less than 10 per cent. in the horse, somewhat more numerous in the dog). Complete details with regard to the dimensions of the trypanosome are not given in this paper. The trypanosomes are somewhat rare throughout the whole course of the disease. As in the disease known as *souma* they are only found in the peripheral blood at the commencement of the disease and during the febrile crises; but even during these crises their presence is by no means constant. Later on in the course of the disease they are impossible to detect even after careful search. In the chronic forms they re-appear towards the termination of the disease and are then very numerous during febrile attacks. A certain diagnosis based on simple examination of the blood even after centrifugation is thus very difficult, if not impossible, and one must resort to test inoculations. The inoculation of 5 or even 10 c.c. of blood into a susceptible animal often gives negative results and thus it is advisable to inject 50 to 80 c.c. of blood or other fluid from the diseased animal.

With regard to the virulence of the organism for various experimental animals the author's investigations gave the following results:—The trypanosome was found to be very virulent for the white rat, which after a period of incubation of about three or four days presented

a severe type of infection lasting on an average from seven to ten days. On post-mortem examination the spleen was found to be enormously enlarged.

The rabbit was only slightly susceptible. The disease took on a chronic form with a slow and irregular course. The symptoms and lesions were similar to those of all the other kinds of trypanosomiasis in this animal.

In the dog the disease ran a sub-acute course with frequently occurring crises. The presence of the trypanosome almost constantly in the blood of this animal subsequent to inoculation makes it very useful for test inoculations.

In the case of two mules the disease ran a relatively rapid course compared with that of the natural affection.

Clinically this trypanosomiasis of Moroccan horses appears to be a distinct morbid entity. However, it presents certain resemblances with *mbori* which, however, is characterised by severe locomotor changes and with *souma*, which runs a more rapid course, and, finally, with *debab* of the camel. Sergent showed that the trypanosome of this disease isolated by Belleval was different from that of *debab*. Laveran also showed that the trypanosome isolated by Delanoë and Fiori from horses at Mazagan differed from the *debab* organism. Bouin's experiments at Marrakech appear to show that the organism of the Moroccan *debab* was less virulent than the equine trypanosome.

The author then proceeds to deal with the invariably unsuccessful attempts made at curative treatment by means of various medicaments comprising arsenic and antimony compounds; these results were summarised in the preceding number of this *Bulletin* [see p. 151]. [A M.S. report giving fuller details of these experiments has just been received.] The article ends with a discussion on the prophylaxis of the disease based on the isolation or slaughter of affected animals, and avoiding areas infested by tabanids.

Di Domizio (Giovanni). **Una tripanosomiasi del dromedario eritreo (Gudhò). Cenni sulle mosche ematofage della Colonia Eritrea.** [A Trypanosomiasis (*Gudhò*) of Eritrean Dromedaries. Notes on Blood-sucking Flies of the Colony of Eritrea.]—*Clinica Vet.* 1918. Aug. 31–Sept. 15. No. 16 & 17. pp. 391–413. With 3 text figs. and 1 plate comprising 11 figs.

Trypanosome diseases in Eritrean dromedaries were first noted by Memmo, Martoglio and Adani (1905). In 1912 Pricolo described a severe infection lasting usually only 24 to 48 hours in dromedaries imported into Libya from Eritrea; a trypanosome 22–30μ long by 4μ broad was discoverable in the blood of these animals. In 1913 Martoglio identified two kinds of trypanosomiasis in the dromedaries of Eritrea, viz., one caused by a trypanosome identical with that occurring in the bovines of the country and known as *giahan* by the natives, and the other known as *atteh*, the trypanosome of which was referred to as a variety of the surra organism. The first accounts of *giahan* were given by Memmo, Martoglio and Adani. These authors stated that a trypanosomiasis occurred among bovines along the coast and in the lower regions of the Sahel district. Goats and Abyssinian sheep were susceptible to infection by this bovine organism. Horses and donkeys were less susceptible. Rats, dogs, and monkeys

appeared to be immune. The trypanosome had the following dimensions,—young forms 14–16μ, adult form 24μ. An important point in the morphology of this organism was that the centrosome was situated at the extreme posterior end and in a few specimens it appeared to be constituted of a minute mass of chromatin.

In his work published in 1913 MARTOGLIO maintained that this affection known as *giahan* occurred naturally also in dromedaries under the native term *gudhò*, meaning decline or misery. The so-called *gudhò* of dromedaries and *giahan* of bovines, moreover, presented the same clinical course, symptomatology, severity, and geographical distribution. But, in a certain percentage of the cases the disease ran an acute course with death occurring in a few weeks, while the remaining cases were of a more chronic character and lasted from two to three months. Among the animals that survived longest there were a certain number of recoveries. The symptoms were oedematous swellings, nervous twitchings, inco-ordination of movement in the hind quarters and, in the case of horses, attacks of paresis. An important biological property of the *giahan* trypanosome was that it was not pathogenic for dogs, rabbits, rats and mice; if the very young animals of these species were inoculated the trypanosomes might propagate for a time but they remained saprophytic and then disappeared completely. These trypanosomiases (*giahan* and *gudhò*) were said to be transmitted by Stomoxydae. According to SERGENT (1914) MARTOGLIO undoubtedly was working with *Trypanosoma cazalboui*.

The other trypanosomiasis of dromedaries known as *atteh* and transmitted, according to MARTOGLIO, by Tabanidae (Haematopota, Pangonia) ran a very chronic course lasting from one to two or more years, wasting and anaemia being the more important symptoms, with a much lower mortality than in the last named affection and probably immunity was subsequently produced. The trypanosome measured about 30μ long (without flagellum which was 8μ long) by 3 to 4μ broad at the level of the nucleus. The centrosome was 3 to 5μ from the posterior extremity, which was generally moderately drawn out and blunted. It differed also from the *giahan* trypanosome inasmuch as it set up a chronic disease in horses and sheep terminating, as a rule, in recovery; it was not pathogenic for cattle although these animals might harbour the parasite in a latent state and their blood prove infective for dogs in from four to five months after infection. It was highly pathogenic for dogs, rabbits, mice, and rats. MARTOGLIO believed that the *atteh* trypanosome was a variety of the surra trypanosome, analogous to that of *mbori*.

PRICOLO and FERRARO (1914) in describing a trypanosomiasis of camels in Tripoli believed that this affection was introduced with imported Eritrean dromedaries and described a trypanosome which was stated to be identical with *T. soudanense*, the causal organism of *el debab*.

The author then goes on to describe at considerable length his own observations on *gudhò*. This disease occurs in all the low-lying and moderately elevated districts in Eritrea with the exception of the pastures lying immediately adjacent to the Red Sea. The losses are greatest on the mountain slopes facing the Red Sea where blood-sucking flies are most numerous. In the western part of the Colony

losses are rare. The incubation period is long (from three to four months) and the first symptoms are a gradual loss of condition, intermittent slight fever, and more or less abundant lachrymation without ocular lesions; the appetite is generally maintained up to the end. Sometimes diarrhoea may set in before death. There are no appreciable oedematous swellings, the excretory system seems to be unaffected. Observations show that the disease might last from five or six months up to two years. The termination is usually fatal and death occurs owing to extreme debility. Recovery when it takes place is always preceded by a long convalescence and appears to be followed by a lasting immunity. The disease shows no great tendency to spread and this appears to be due to the fact that camel-men take care to avoid the zones infested with blood-sucking flies. There is no noteworthy post-mortem lesion.

The author dwells at length on the distribution of the various blood-sucking flies in the affected districts. A list of the species has already been given in this *Bulletin* [FERRARO, Vol. 5, No. 4, p. 253]. It appears that all these species are capable of transmitting the disease mechanically but the most deadly localities for dromedaries are not those infested with Stomoxydae but those containing Pangonia and Tabanidae. The last-named, known as the *aur*, are particularly feared by camel-men.

The trypanosome of *gudhò* when examined in the fresh state shows fairly active translatory movements. At the commencement of the disease and for a short time afterwards the trypanosomes are found abundantly in the blood (5 or 6 per field of the microscope, objective 1/15, ocular 6, Koristka) but the numbers may show considerable variations when blood is examined at different times. Subsequently the trypanosomes become rarer and disappear for more or less prolonged intervals. Their reappearance is generally marked by a febrile attack. In preparations stained with Giemsa the trypanosomes appear slender with numerous folds in the undulating membrane and a moderately long free flagellum showing usually two or three spirals. The dimensions varied from 18–26μ in length including free flagellum by from $1\frac{1}{2}$ to 2μ broad at the level of the nucleus. The predominant forms measured from 22 to 25μ. Forms 22μ in length were less numerous while those 18μ long were rare. The breadth did not seem to be in direct proportion to the length, forms 25 to 26μ long by 1 to $1\frac{1}{2}\mu$ broad and forms 18 to 20 by 2μ being observable. Forms about to undergo division might measure 2 to $2\frac{1}{2}\mu$ broad by 28 to 30μ in length. Very rarely stumpy forms of medium length and about 4μ broad could be seen. The centrosome, which was rounded and distinct, was usually situated about 2μ from the posterior extremity, which was tapering, slightly rounded, rarely markedly blunted. The flagellum was well developed along its whole course. The nucleus was oval, 2 to 3μ long by 1 to 2μ broad. The cytoplasm sometimes contained minute chromatin granules around the centrosome and nucleus.

A more or less marked leucocytosis with an appreciable increase in the large and small mononuclears and also changes in the red corpuscles could be seen in the blood of affected animals.

The author next deals with the identification of this trypanosome and points out that it shows fairly distinct morphological differences

from that of *giahan*, besides being somewhat smaller and provided with a more distinct undulating membrane. The centrosome is situated at a distance of 1½ to 2 to 3μ from the posterior end while that of *giahan* (*T. cazalboui* according to LAVERAN and SERGENT) possesses a terminal or almost terminal centrosome. He further points out that the symptomatology of *gudhò* differs in many respects from that of *giahan*, the incubation period is longer, and the disease runs a more protracted course without showing neuromotor changes as in the case of *giahan*. The *gudhò* trypanosome is infective for dogs. Although no attempt at experimental transmission to cattle was made there is every reason to believe that the *gudhò* trypanosome is not infective for these animals under natural circumstances, inasmuch as cattle remained unaffected in localities where the blood-sucking flies suspected to transmit *gudhò* were very prevalent. No trypanosome was visible in the blood of a large number of such bovines although dromedaries undoubtedly infected had passed through the district. The immunity of the native cattle towards the trypanosome was also proved by PRICOLO and FERRARO. It is possible that the bovines may act as carriers of the *gudhò* trypanosome and on the other hand that dromedaries may harbour the *giahan* trypanosome in a latent and inoffensive state. After some further discussion on the identity of the trypanosome the author concludes as follows :—

"There exists in the Colony of Eritrea a trypanosomiasis of dromedaries called *gudhò* by the natives, which is transmitted by Tabanidae, at least, most commonly, and probably also by Stomoxydae and Lyperosia.

"The causal organism of *gudhò* in dromedaries can be differentiated morphologically and biologically from that of *giahan* in bovines. It is by no means probable that it can be identified with that of *atteh*, the other trypanosomiasis in Eritrean dromedaries.

"The morphology of the parasite, the clinical aspect of the disease set up by it, its mode of transmission (by tabanids), and its geographical distribution cause one to believe that the *gudhò* trypanosome is identical with *T. soudanense* of camels along the Mediterranean Coast of Northern Africa, while that of *atteh* should probably be designated as a variety of *T. evansi* in the same way as that of *mbori*. The question requires further investigation."

MITZMAIN (M. Bruin). **The Rôle of *Stomoxys calcitrans* in the Transmission of *Trypanosoma evansi*.—*Philippine Islands, Bureau of Agric.*** Bull. No. 24. pp. 51. With 5 plates & 17 tables. 1913. Manila: Bureau of Printing.

In this tardily received paper an account is given of a large number of carefully performed experiments carried out by the author in the Philippine Islands with the object of ascertaining the rôle of the common horse biting fly in the transmission of the surra trypanosome. An extract of a paper by this author entitled "Collected Studies on the Insect Transmission of *Trypanosoma evansi*" has already appeared in this *Bulletin* [Vol. 5, No. 1, pp. 10–14]. In that paper it was stated that the evidence was strongly in favour of the gadfly *Tabanus striatus* Fab. acting as the transmitter, by mechanical means, of the trypanosome in the Philippines. Experiments were also described to ascertain the rôle of mosquitoes, *Lyperosia exigua*, *Philaematomyia crassirostris*, *Hippobosca maculata*, blood-sucking gnats, and the common house fly *Musca domestica* in the transmission

of surra; the results were negative, but the common house-fly was found capable of playing an indirect part in transmission. As in the preceding paper an interesting summary of the literature on the subject is given in this paper. The author's general summary is as follows:—

"1. Only negative results were obtained in the attempts at direct mechanical transmission of surra with flies which were induced to bite healthy animals at intervals ranging from five minutes to three days after being permitted to complete the feeding upon infected animals. Thousands of *Stomoxys calcitrans* were employed in 29 experiments involving the use of 3 horses, 6 monkeys, and 22 guinea pigs.

"2. Twenty-seven experiments were performed in attempts to transmit surra by the interrupted method of feeding. All attempts proved negative *where a single application of a varying number of flies was used*, as many as 38 on a horse, and a maximum of 40 on a small guinea-pig. The intervals between feeding on infected and healthy animals averaged twenty-five to forty seconds in the two instances cited.

"3. In 3 trials, interrupted feeding was employed in successive daily applications. In attempting to determine the minimum number of bites necessary to infect an animal, as high as 40 were followed by negative results. The only positive result obtained was produced from a succession of 206 interrupted bites in which the flies were transferred immediately from the infected to the clean animal. The flies were applied thirty-two hours during a period of six days.

"4. The results of these experiments indicate that *Trypanosoma evansi* does not develop in the body of *Stomoxys calcitrans*. Ninety-four days was the longest period in which laboratory-bred flies were tested for a cyclical development, and sixty-seven days the maximum for wild flies.

"5. Organisms of surra were not found in *Stomoxys calcitrans* beyond eighteen hours after feeding on an infected animal, and the limit for infection by inoculation was ascertained in these experiments to be six hours.

"6. Pathogenic trypanosomes were found in the proboscis of the fly thirty seconds after feeding on infected blood. Within one minute and thirty seconds the organisms were not present in the mouth parts in a form capable of infecting by inoculation into guinea-pigs.

"7. The wounds made by the labium of *Stomoxys* were not found to be a suitable channel for infection. Consequently it is not likely that surra in domestic animals is produced through this avenue by external contamination; namely, faeces, mouth parts, and pulvilli of infected flies.

"8. The intimate relation in the feeding habits of *Stomoxys* and of house flies has been pointed out. *Stomoxys* has been demonstrated to provide through its bites the infection of *Musca domestica* and other dung flies. These flies have been demonstrated to act as carriers, harbouring the surra organisms for several hours.

"9. No evidence was obtained to indicate that *Tr. evansi* is hereditarily transmitted to the offspring of *S. calcitrans*. The larva of this fly fed on surra blood does not continue to harbor the trypanosome and the fly is 'clean' upon reaching maturity.

"10. It is demonstrated that the individual glass-tube method is the most suitable for applying flies in feeding on experimental animals and for keeping flies for long periods under laboratory conditions."

Galli-Valerio (B.) & Stalder (H.). **La piroplasmiase des bovidés en Suisse.** [Bovine Piroplasmosis in Switzerland.]—*Schweiz. Arch. f. Tierheilk.* 1918. Oct. Vol. 60. No. 10. pp. 471–477. With 1 fig.

This article apparently refers to the first authenticated cases of bovine piroplasmosis in Switzerland. Since 1912 Stalder has observed a few cases of acute anaemia accompanied by severe haemoglobinuria among the milch cows of the Cossinay districts. The symptoms

became aggravated to such an extent that the animals were slaughtered in from three to four days after the onset of symptoms and on post-mortem examination dropsy, fatty degeneration of the liver and increased size and diffluent consistency of the spleen were very noticeable. Medicinal treatment produced no effect.

The symptoms and lesions described resembled so closely those of piroplasmosis, the presence of which in Switzerland had been suspected by GALLI-VALERIO for a long time, that a microscopic examination of the blood was made. After staining with Giemsa it was found that several abnormally large red corpuscles contained basophilic granules; the corpuscles invaded with piroplasms were somewhat rare. The most common forms of the parasite were pear-shaped forms occurring more often singly than in pairs within each corpuscle. They were stained of a light blue colour, especially towards their margins, with clear spaces within their thicker parts. One or more red stained chromatin granules were observable particularly towards the thinner ends or on the borders. The pear-shaped forms were from 3 to 4 by 1 to 1·5μ in dimensions. The larger isolated forms were of most common occurrence. In some corpuscles ovoid or almost spherical forms with fragmented chromatin could be seen. A few free-lying piriform bodies were also noted. The parasites were extremely rare in the liver and kidneys but more easily found in the spleen. In some of the red corpuscles there were up to three pear-shaped forms arranged in fan-shaped fashion. Many of the forms seen in the spleen were extra-corpuscular on account of the marked destruction of the blood corpuscles.

The question arises as to whether the species of piroplasm encountered by the authors belonged to *P. bigeminum* Smith and Kilborne, or *P. divergens* McFadyean and Stockman. The former species is held to be the cause of bovine redwater in tropical countries and the second in Europe. These species have been differentiated not only on account of their morphological appearances and minor differences in dimensions but also principally on account of the fact that they are incapable of setting up reciprocal immunity. The authors state that if these two organisms are really distinct species it is highly probable that the form observed by them was *P. divergens.* The occurrence of piroplasms singly within the corpuscles has been noted several times by LIGNIÈRES (1900) in Argentina and the very large piriform bodies may be observed also according to NUTTALL in the case of *P. divergens.* [The figures presented by the authors do not enable one to form an opinion as to which species of parasite they really represent. None of the figures represent a pair of parasites within a single corpuscle.—ED.] The fact that the parasites may sometimes be very rare even in acute cases has been pointed out by LIGNIÈRES. This fact probably explains why it has been very difficult to demonstrate the existence of bovine piroplasmosis in many localities.

It is stated that bovine piroplasmosis thus occurs in Switzerland in centres which may from time to time present cases of acute infection. These centres may prove of great danger to healthy animals introduced. Although no adult ticks were found on the cases examined transmission must have been by means of ticks. According to

Galli-Valerio's observations *Ixodes ricinus* is of very common and wide-spread occurrence in the Canton of Vaud where these animals came from, while *I. hexagonus* is found there more rarely.

Cominotti (Luigi) & Di Domizio (Giovanni). **L'emoglobinuria dei bovini delle regioni prealpine è una piroplasmosi. Nota preventiva dei dottori.** [The Haemoglobinuria of Bovines in the Cisalpine Districts (of Italy) is a Piroplasmosis. Preliminary Note.]—*Clinica Vet.* 1918. Aug. 31–Sept. 15. No. 16 & 17. pp. 425–430.

In this article the authors bring forward evidence to show that the acute form of cattle redwater occurring for many years past throughout probably the whole of the cisalpine regions in Northern Italy is due to a piroplasm. The origin of the disease had not hitherto been discovered on account of the fact that the piroplasms are often extremely rare in the blood even in fatal cases, although in nearly all cases they may be found in the spleen. The authors believe that the piroplasm is not of the *bigeminum* type on account of its relatively small dimensions and the predominance of ring-shaped forms; paired forms with their pointed extremities directed towards each other and rod-shaped forms are also not observable.

Ticks of the species *Margaropus annulatus* are said to be of frequent occurrence in the affected districts.

Sergent (Edmond) & Sergent (Etienne). **Sur le paludisme des Oiseaux du au *Plasmodium relictum* (vel *Proteosoma*).** [Bird Malaria due to *Plasmodium relictum*.]—*Ann. Inst. Pasteur*, 1918. Aug. Vol. 32. No. 8. pp. 382–388. With 1 chart & 1 text fig.

This article gives a résumé of the observations carried out by the authors at Algiers during the course of the last 12 years on Proteosoma infections of canaries. Five hundred and sixty birds were infected in all either as the result of the bites of infected Culex or intraperitoneal inoculation of blood from infected birds. The resulting infection was of approximately the same character in both cases. The period of incubation varied from three to ten days. In one case only it lasted over a month and the disease subsequently ran its normal course. A period of acute infection then follows during which parasites can be observed daily in the blood and this lasts on an average nine days without remissions (minimum 3, maximum 29 days). All the birds showed during this period at least one parasite per field of the microscope (1/15th lens) on an average for six consecutive days (minimum 1, maximum 27 days). In some cases 80 per cent. of the red corpuscles were invaded and up to four parasites might be found within a single corpuscle. The mortality amounted to 61·3 per cent. during this acute stage.

On post-mortem examination the spleen was found to have become enormously enlarged and black in colour. In the normal canary the spleen measures 3 to 4 by 2 millimetres on an average, but in the case of birds dead during an acute attack it might reach up to 15 by 5 millimetres. After this acute stage the parasites disappear in a few days (from 3 to 6 days) from the peripheral blood. Subsequently in some cases there is a complete absence of parasites in the peripheral blood while in other cases a few rare parasites appear at irregular intervals.

During this stage, which may last over 15 months, inoculation with a certainly infective virus does not bring about the appearance of parasites in the peripheral blood. Sometimes there occurs a very mild relapse of brief duration with a very short incubation period (1 to 3 days). This is analogous to the so-called "acclimatisation" of human beings long resident in malarial countries. This immunity is acquired from the sixth day after the commencement of the blood invasion. The birds remain infective for canaries inoculated with their blood or for Culex allowed to bite on them during this period. This stage may be of much shorter duration. After four months the canaries may no longer be infective and appear to be completely recovered. If the spleen is examined it shows no pigment and it is found to have resumed its normal dimensions. In other cases these birds may succumb more readily than non-infected canaries as the result of adverse circumstances such as cold or sudden heat. The spleens of such birds are then found to be large and black. The immunity set up is thus relative. The authors have previously shown that this relative immunity can be set up by the inoculation of sporozoites maintained in vitro.

The bird may be infected in the following ways:—(1) by intraperitoneal inoculation. A few drops of infective blood thus inoculated set up infection with certainty and give much more constant results than subcutaneous or intramuscular inoculation. The authors' virus obtained originally from a Mitidja sparrow was preserved at first by passage alternately through canaries and gnats, but for the last four years this method has been replaced by intraperitoneal inoculation. The incubation period lasts on an average from 7 to 8 days, although the first parasites may appear at the end of three days. The longest period observed was 10 days. (2) By smearing Culex on the skin of the canary. The authors have already shown that if infected gnats are crushed and rubbed on the skin of canaries about four out of every 10 birds become infected. (3) By intrarectal injection; after injection of infected blood one canary out of six becomes infected, the five non-infected ones were shown to have acquired no immunity.

Infection of mosquitoes.—The authors have shown that the sexual development of *Plasmodium relictum* may become accomplished in the body of *Stegomyia fasciata*; this fact has been subsequently confirmed by the observations of NAUMANN (R. O.). In addition the authors have now demonstrated that the complete development of the parasite may also take place in *Culex sergenti* Theobald, *Theobaldia spathipalpis* Rondani, *Acartomyia mariae* Sergent and Theobald; the larvae of these flies live only in salt water (from 30 to 60 grammes of salt per litre) in creeks along the Mediterranean coast. The infection transmitted by the bite of Acartomyia is well marked but delayed. The incubation period is 11 days instead of from 3 to 10 days.

As opposed to what occurs in filariasis one finds in the proboscis of a mosquito that has imbibed Plasmodium blood approximately the same number of parasites as in the circulating peripheral blood.

At a temperature of 11·5° to 24° C. the zygotes take more than two months to mature; sporozoites do not become liberated until between the eighth and ninth week.

The authors have shown that in summer (18° to 30° C.) *Culex pipiens* that have infected a canary can without further imbibition of parasites infect a second canary within a period of one month, but fail to infect a third bird. The infected *C. pipiens* may retain their sporozoites for five months at a temperature of 8–25° C. At the end of this time the size of the sprozoites contained in their salivary glands may become less than that of normal young sporozoites (from 8 to 10μ instead of 11 to 14μ). A canary bitten by two gnats of this same lot (those examined had all shown sporozoites) did not present any infection subsequently. However, examination of the salivary glands of a Culex of the same lot showed 9 days afterwards numerous sporozoites of normal appearance.

Culex born from infected gnats were found to be not infective showing that the parasite is not passed through the egg.

The gnats were found to have acquired no immunity, as Culex that had ceased to become infective became infected again after sucking Plasmodium-containing blood.

The authors then describe two trypanosomes, one from the blood of a canary and the other from the blood of the Algerian sparrow.

CREMONA (Pietro). **Sulla diarrea rossa (coccidiosi intestinale) dei bovini del Veneto.** [Bovine Red Dysentery (Intestinal Coccidiosis) in Venetia.]—*Nuovo Ercolani.* 1918. May 31. Vol. 23. No. 10. pp. 113–115.

In this short note the author describes a few cases of coccidiosis in cattle, tending to give support to the view put forward by SANLORENZO that the disease is by no means rare in Italy [see this *Bulletin,* Vol. 6, No. 1, p. 9]. In one outbreak involving both calves and adult cattle the disease was reported to have assumed a somewhat virulent character; the animals became affected with foetid diarrhoea, rapid wasting, and finally convulsive tremors just before death, which took place in three or four days. Good results were obtained by the administration of thymol *per os* in 10 gramme doses for calves and 15 gramme doses for adults. Five gramme doses were given as a preventive to the apparently healthy in-contact cattle.

BALLS (A. K.) & MORAL (José D.). **Studies on the Action of Certain Antiseptics, Toxic Salts, and Alkaloids against the Bacteria and Protozoa of the Intestine of the Rabbit.**—*Proc. Soc. Exper. Biol. & Med.* 1918. May 15. Vol. 15. No. 8. p. 125. *Jl. Infect. Dis.* 1918. Oct. Vol. 23. No. 4. pp. 382–391. With 4 tables.

The following summary of the above work is given in the first paper.

"The authors believe from theoretical considerations that there is a difference in the susceptibility of bacteria and protozoa to the action of antiseptics. This difference is found to exist between the intestinal bacteria and the intestinal protozoa (*Giardia cuniculi*) of the rabbit, when treated with certain dilutions of chloramine T, brilliant green, 'Halazone' and copper sulphate.

"In these cases the protozoa are more resistant than the bacteria. Therefore bacterial-free material containing live protozoa is easily obtained.

"This behavior does not hold for free living protozoa which are more sensitive to the action of these same antiseptics than the bacteria which accompany them in nature. Free living protozoa are also less resistant when compared with parasitic protozoa.

"Increase in temperature greatly increases the effect of the antiseptics, especially against the protozoa.

"The authors conclude:

"(1) In the intestinal content of the rabbit, it is possible to show that resistance of *Giardia cuniculi* against the action of certain antiseptic substances is markedly greater than the resistance of the intestinal bacteria. It is possible by making use of this difference in resistance to obtain *Giardia* free from all living bacteria, but attempts to subsequently grow them in pure culture have not succeeded. (2) The *Giardia* are more resistant to the action of these toxic substances than are the free living protozoa studied. (3) A technical method has been developed which we believe will be useful in demonstrating the applicability of intestinal antiseptics against both the protozoa and the bacteria of the intestine."

DISEASES DUE TO METAZOAN PARASITES.

LISTON (W. Glen) & SOPARKAR (M. B.). **Bilharziosis among Animals in India. The Life-Cycle of *Schistosomum spindalis*.** Preliminary Note.—*Indian Jl. Med. Res.* 1918. April. Vol. 5. No. 4. pp. 567–569.

Schistosomum spindalis was first found by MONTGOMERY (1906) in two Plains cattle at Muktesar in India and he proposed this name for the new species on account of the characteristic spindle-shaped ova. Outside India it has been found but once, in Sumatra, by VRYBERG (1906). In the course of an investigation undertaken by the authors into the possibility of the spread of human bilharziasis in India through the arrival of infected troops one of the several species of fresh water molluscs (*Planorbis exustus*) met with in Bombay was found to be infected with a certain furcocercous cercaria very closely resembling the cercarial stage of the schistostomes found in man in Egypt. Experiments were made in order to ascertain whether these were the cercariae of human schistostomes.

In the first instance an attempt was made to infect a monkey and some guinea-pigs with the cercariae, for it has been shown that in the case of the cercariae of human schistostomes both these animals become heavily infected and mature male and female worms can be recovered from them in about 10–12 weeks. A monkey was drenched with water containing a very large number of the organisms; during the succeeding three months it showed no signs of disease and on post-mortem examination no worms could be discovered. Two guinea-pigs were subjected to infection by allowing water containing cercariae to dry on the shaved surface of the abdomen and groins; they were also made to drink some of this water. One of the guinea-pigs died seven weeks after infection and on post-mortem examination several Bilharzia worms were found in the liver, spleen, and portal veins. The worms, however, were all males and no females could be detected. The other guinea-pig was killed two weeks later and again only male worms were found.

These results showed that the cercariae were a stage in the development of some schistostome and it was probable that they were not the human species found in Egypt for they had failed to develop in the monkey, which had been shown to be a suitable host for the Egyptian worms.

As bilharziasis is known to exist in goats, sheep, and cattle the authors next endeavoured to find whether the cercariae would develop in the body of a goat. A young kid was therefore subjected to infection through the skin by allowing water swarming with the cercariae to remain in contact with the shaved surface of the abdomen and groins for 15 to 20 minutes. Two months and a half later the kid began to suffer from diarrhoea and an examination of its faeces revealed the presence of peculiar spindle-shaped eggs containing active miracidia, corresponding exactly to the description given by Montgomery of the eggs of *Schistosomum spindalis*. The kid gradually grew worse, suffering from severe anaemia, diarrhoea, debility, and paraplegia, with oedematous swellings under the jaw and along the neck, and it died a fortnight later. On post-mortem examination numerous worms in all stages of development were found in the liver. The larger portal veins were packed with worms. The mesenteric veins contained several paired forms. Most of the female worms contained characteristic spindle-shaped ova in the uterus and numerous eggs were found in the minute blood vessels and in the walls of the intestine. The worms were identified as *Schistosomum spindalis* Montgomery.

An attempt was then made to infect snails with the miracidia hatched out of the spindle-shaped eggs obtained from the goat, in order to ascertain whether the same kind of sporocysts and cercariae would develop in them as were found in naturally infected snails. The experiment proved successful and after five weeks most of the snails that were alive had developed sporocysts and cercariae morphologically identical with those with which the kid had been infected. Details concerning the various stages in the development of the worm in the intermediate and final hosts are promised in a further communication.

Hall (Maurice C.), Wilson (Robert H,), Wigdor (Meyer.) i. **The Anthelmintic Treatment of Equine Intestinal Strongylidosis.**—*Jl. American Vet. Med. Assoc.* 1918. Oct. Vol. 54. New Ser. Vol. 7. No. 1. pp. 47–55.

—, —, —. ii. **Some Notes on the Treatment of Equine Ascariasis and Oxyuriasis.**—*Ibid.* pp. 56–57.

iii. Wigdor (Meyer). **A Study of the Character of the Feces due to Various Foods in Connection with Anthelmintic Investigation.**—*American Jl. Vet. Med.* 1918. Sept. Vol. 13. No. 9. pp. 441–444.

The very common and rather serious parasitic infestations of the large intestine of the horse, due for the most part to species of the genera Strongylus (Sclerostomum) and Cylicostomum (Trichonema, Cylicostomum, "*Sclerostomum tetracanthum*"), have hitherto been regarded as very difficult of treatment. For example, Railliet (1915) states that it is difficult to expel parasites from the large intestine by oral

medication in any host species, and this is the general view of parasitologists and veterinarians. However, to the authors' surprise their experiments showed that the above strongyles could be removed with great certainty and with a high degree of efficacy as regards the number removed compared with the number present. Inasmuch as their findings were completed by post-mortem examination their results are of much value.

The high degree of efficacy obtained in the removal of worms from the caecum and colon of the horse was attributable to the increase in the time factor as regards period of exposure of the worm to the anthelmintic. Anthelmintic efficacy is said to be the product of certain factors,—the potency of the drug, the amount of the drug, the contact with the worms, and the period of contact with the worms. In a general way, an increase in any of these factors increases their product, which is the anthelmintic efficacy. Food and drugs pass rather rapidly from the stomach and through the small intestine of the horse, but they lie for comparatively long periods in the caecum and double colon, and thus the high efficacy of the anthelmintics is probably due to the long period during which they may operate in the large intestine. In the case of the horse's caecum food enters through one aperture and passes out through another, a condition which is not present in the other domesticated animals; in the experiments of Hall and Foster (1918) it was found quite possible for drugs to pass the ileo-colic or ileo-caecal valve into the colon in dogs without entering the caecum. This is not possible in the horse, so that drugs can be depended on to enter the caecum if they pass the ileo-caecal valve.

The method used in the experiments was the one already published by Hall (1907) in connection with the study of the action of carbon bisulphide on bots. One author administered the drugs, supervised the feeding and fasting of the horses and the collection of the manure, and made the general post-mortem examination. The others made daily collections and identifications of the worms from the manure, collected and identified the worms present post-mortem, and noted the condition of the digestive tract post-mortem. Worms were only identified as far as their genus was concerned; the results did not indicate that any particular species showed any special resistance.

The authors quote references dealing with the treatment of strongylidosis by means of drugs,—thymol (Giles, Theobald), atoxyl (Dorn and Bochberg), carbon bisulphide (Leneveu, 1915), thymol, santonin, and aloes in the form of a ball (Conreur 1915), and oil of chenopodium (Thum 1915, Wooldridge 1916).

The following are the authors' conclusions to their ten experiments:—

"Iron sulphate in the light dose used (2 drams in a mash daily for 7 days) was a failure, removing no *Strongylus* and less than 1 per cent. of the *Cylicostomum* present. Not too much may be concluded in regard to the value of larger doses, but in view of the fact that this treatment is not recommended for strongyles, it is likely that it is not of much value. This conclusion is substantiated by the poor results obtained from the administration of 7 ounces of iron sulphate over a period of 12 days in the case of Horse No. 1031.

"Tartar emetic in the light dose used (2 drams in a mash daily for 5 days) was a failure, removing less than 1 per cent. of the strongyles present. The evidence of severe irritation in the digestive tract post-mortem inclines us to believe that this drug is not apt to prove of much

value in this condition, as increased size of dose to secure greater efficacy would mean a degree of gastro-intestinal irritation that in our opinion should be avoided

"Turpentine in a moderate dose (2 ounces in a quart of linseed oil) was a rather effective remedy in the one test made, removing all of the *Cylicostomum* and 48 per cent. of the *Strongylus*.

"Oil of chenopodium was a failure in small doses with less than a 24 hour fast, failing to remove 1 per cent. of the strongyles present in a dose of 8 mils; it was less than 1 per cent. effective against *Strongylus* and only 29 per cent. effective against *Cylicostomum* in a dose of 10 mils. In larger doses, with less than a 24 hour fast before treatment, the findings are somewhat contradictory; a 16-mil dose was 100 per cent. effective against *Cylicostomum* and 76 per cent. effective against *Strongylus*, while an 18-mil dose was 11 per cent. effective against *Cylicostomum* and less than 1 per cent. effective against *Strongylus*. In these same larger doses, with fasts of at least 24 hours, the treatment is highly effective. In one case, where the chenopodium and linseed oil were given simultaneously, the treatment was apparently 100 per cent. effective against strongyles; in another case, where the linseed oil was given 2 hours after the chenopodium, the treatment was 100 per cent. effective against *Cylicostomum* and 96 per cent. effective against strongyles; in another case, where the chenopodium was given in divided doses followed by linseed oil an hour after the last dose, the treatment was 100 per cent. effective against *Cylicostomum* and 95 per cent. effective against *Strongylus*.

"Summary. Contrary to what has been supposed, the removal of strongyles from the large intestine of the horse presents no great difficulties. The remedy of choice is oil of chenopodium, which displays an efficacy of 95 to 100 per cent. when given to horses fasted 36 hours and given in doses of 16 to 18 mils, in one dose or in divided doses, accompanied by a quart or a litre of linseed oil or followed one or two hours later by this amount of linseed oil. The small worms, *Cylicostomum*, are more readily removed than the large, red palisade worms, *Strongylus*, probably due to the fact that *Strongylus* attaches to the mucosa and *Cylicostomum* does not. Turpentine appears to be the second choice of the remedies tested. In the doses used, iron sulphate and tartar emetic gave very poor results and promised little of value in the treatment of strongylidosis."

[It is not clear from this paper whether the drugs mentioned would have any effect upon the innumerable embryos found imbedded in the mucous membrane of the caecum and colon in severe cases of equine strongylidosis, and which no doubt contribute very largely to a fatal termination, or whether the results apply only to those worms lying in the bowel contents of milder cases.—Ed.]

ii. These investigations were carried out concurrently with the above. Of the ten horses used in the above experiments seven were infested with *Oxyuris equi*, and eight with *Ascaris equorum*. The various treatments enumerated above failed entirely to remove the oxyurids and were also entire failures in the case of four of the eight horses affected with ascarids. These results are not considered to be especially encouraging but they constitute a valuable guide for further work on the subject.

iii. The effect of the nature of the food on the character of the faeces was studied in over 100 dogs out of a series of 325 dogs used in anthelmintic investigations, and the following is briefly a summary of the observations:—

"Soft light-coloured plentiful feces are indicative of a bread diet. Dark fairly hard feces in comparatively small amounts are indicative of a raw-meat diet. Very dark fairly soft feces in small amounts are indicative of a finely chopped cooked-meat diet. (This seems to be especially true when the meat is fed while still warm). Clay-colored, brittle feces in small lumps are indicative of some bone constituent in the diet.

"Therapeutic doses of oil of chenopodium or distillation products of oil of chenopodium, when given with castor oil, usually cause greenish, fluid feces, regardless of the diet.

"Excessive or lethal doses of chenopodium constituents cause constipation, in spite of therapeutic doses of castor oil, defecation being suppressed for a period of one or more days or the feces being hard and dark."

HADWEN (S.). **Natural Occurrence of Eosinophilias.**—*Jl. Parasit.* 1918. Mar. Vol. 9. No. 3. pp. 135–137.

Smears made from the swelling observed in from 20 minutes to half an hour after subcutaneous injection of juices obtained from Hypoderma larvae contaminated with bacteria show phagocytosis by the eosinophiles. The reason for the eosinophiles assuming the role which is usually assigned to the neutrophiles is apparently to be found in the fact that the bacteria are rendered attractive by their being bathed in verminous juices. These findings, which are in agreement with those of WEINBERG and SEGUIN (1914–1915), indicate that the eosinophiles play a very important role in picking up the bacteria which are introduced into the body by the bites of intestinal parasites and in neutralising toxins which may be absorbed. The same effect may be produced by puncturing or crushing a warble larva *in situ* under the skin.

It can be proved that the eosinophiles are attracted by the secretions and excretions of the warble larvae alone and not by bacteria if one examines the fluids in the swellings produced by sterile larvae or by the injections of sterile extracts. On the other hand neutrophile leucocytes are found to be the immensely predominating type in smears made from purulent subcutaneous cavities containing warble larvae and invaded by bacteria. Moreover, if one instils a few drops of warble juice into a steer's eye the cells contained in the muco-purulent discharge subsequently produced (9 hours later) are found to be practically all eosinophiles. This experiment also shows that the eosinophile cell is par excellence the agent which truly repels and neutralises verminous products.

Experiments are contemplated to determine what curative effects the injection of worm juices may have on a verminous infestation.

VAN ES (L.) & SCHALK (A. F.). **Sur la nature anaphylactique de l'intoxication parasitaire.** [Anaphylactic Nature of Parasitic Intoxication.]—*Ann. Inst. Pasteur*, 1918. July. Vol. 32. No. 7. pp. 310–362. With 1 text fig. & 4 charts.

The experiments described by the authors in this paper were performed at the Agricultural Station, North Dakota, U.S.A., in connection with their investigations on the nature of "swamp fever" in horses. In 1914 K. R. & R. SEYDERHELM of Strassburg, in a series of three publications on this affection, argued that it could be set up artificially by the injection of watery extracts of *Gastrophilus equi* and *hemorrhoidalis*, and that in natural conditions it was not set up by the filterable virus of VALLÉE & CARRÉ. [The latter authors, however, (see this *Bulletin*, Vol. 4, No. 3, p. 124) subsequently showed that the SEYDERHELMS' interpretation of the action of their larval extracts was obviously fallacious.—ED.] Van Es and Schalk likewise state at the beginning of their paper that the conclusions of the SEYDERHELMS were of an astonishing nature and creative of great

doubt. The idea that insects played a part as vectors contained nothing new or unexpected but the rejection of a living virus as the cause of an apparently infectious disease was surprising. Nevertheless the results reported to have been obtained could not be accepted without careful verification and consequently the experiments described in this paper were performed in order to throw more light on the new theory advanced. In the first place the investigations were directed towards studying the effects produced by injections of extracts of Gastrophilus larvae into the horse.

In summarising the results obtained in the course of a very considerable number of carefully performed experiments with extracts of bots and various parasitic worms the authors feel justified in drawing up the following conclusions :—

" (1) There is no reason to believe that species of Gastrophilus play a specific role in the etiology of infectious anaemia or 'swamp fever' of horses.

" (2) The severe intoxications following upon injections of bot extracts are not caused by a specific substance in the manner of the so-called 'oestrine' of the Seyderhelms.

" (3) Such intoxications are only manifestations of anaphylaxia and are strictly analogous to those provoked by any other kind of protein material.

" (4) Several species of parasites sensitise their hosts which, after an initial (*dechâinante*) injection or instillation, respond by anaphylactic or allergic reactions.

" (5) The toxic properties capable of becoming evident to a striking degree in the case of extracts of certain parasites are due to a specific sensitisation of the animals at some anterior date.

" (6) It is reasonable to suppose that the substances which provoke the anaphylactic shock may be introduced into the circulation by the same channels as those along which the sensitising materials travelled beforehand.

" (7) Owing to the more or less constant presence of certain parasites in some part of the body it is quite possible that the latter is constantly charged with anaphylatoxins of parasitic origin.

" (8) It is also possible that such an intoxication may lead to morbid changes of a more or less well-defined and characteristic nature.

" If one accepts this idea with regard to a parasitic anaphylaxia several problems become presented to the investigator. For example, what are the consequences of such a prolonged anaphylactic intoxication ? Does it bear any relationship with any chronic diseases such as various types of anaemia, sclerosis, parenchymatous degenerations and morbid conditions hitherto lightly attributed to auto-intoxication, and further what modifications are brought about in the composition of the blood of some of the anaphylactic horses used in the experiments and found to be capable of producing febrile reactions in subjects inoculated with it ? . . . Hadwen's discovery " [see this *Bulletin*, Vol. 5, No. 2, p. 109] " also presents a number of points of great practical interest. It might be employed as a method of diagnosis in certain parasitic diseases. It would be possible in the case of a flock affected with gid to determine which sheep harboured cysts by obtaining an ocular reaction after the instillation of an extract of *Taenia coenurus* or the contents of its cyst. The allergic or anaphylactic reactions might also serve in the course of researches on the biological relationships existing between the parasites and their hosts. . . ."

DE MEZA (John). **The Common Ticks of Nyasaland with some Special Notes on the Anatomy and Biology of Ticks in General.** — *Nyasaland Protectorate. Department of Agriculture.* Bull. No. 1. of 1918. 32 pp. With 13 text figs. Zomba : Govt. Printer.

This short monograph aims at giving " a short general description of the Order, describing the points which distinguish the different

sub-families and genera; to describe the biology and anatomy of ticks in general, and to describe in some detail the disease-causing ticks of Nyasaland giving at the same time their life history." Although the author's information has been abstracted for the most part from the publications of NUTTALL (G. H. F.) it nevertheless presents a useful elementary summary on the subject of ticks together with a number of clear sketches. The common ticks of Nyasaland concerning which more or less detailed information is given are the following:—*Argas persicus, Ornithodorus moubata, Boophilus decoloratus, Haemaphysalis leachi, Dermacentor rhinocerotis, Rhipicephalus appendiculatus, R. evertsi, R. falcatus, R. simus, R. capensis, Hyalomma aegyptium, Amblyomma variegatum, Amblyomma hebraeum* and *Aponomma exornatum.*

BISHOPP (F. C.), MITCHELL (J. D.) & PARMAN (D. C.). **Screw-Worms and other Maggots affecting Animals.**—*U. S. Dept. Agric., Farmers' Bull.* 857. 1917. Sept. 20 pp. With 8 text figs. Washington: Govt. Ptg. Office.

The so-called "screw-worm" inflicts enormous losses on the stock-raisers of Texas, Oklahoma, New Mexico, Arizona and South California during the warmer periods of the year. In some districts the rearing of young calves is nearly entirely prevented on account of its ravages, adult stock are in many cases killed outright or maimed permanently, while infested sheep always lose flesh and their milk production decreases. The expense of watching herds and treating infested animals also is considerable. The maggots of several other kinds of flies in addition infest wounds and "blow" soiled wool on sheep. All these flies breed in decaying animal matter, especially in carcases of large animals. Carcases should thus be disposed of by burning or by burying under at least two feet of soil after covering with quicklime.

An extract has already appeared in this *Bulletin* [(DUNN, L. H.), Vol. 6, No. 3, pp. 161–163] dealing with the nature of the injuries due to this screw-worm pest together with an account of its life history and methods for its control.

For destroying the screw-worm maggots in a wound nothing better than chloroform has been found. The dead or comatose maggots should be removed with a pair of forceps, the wound cleaned out with 5 per cent. carbolic acid solution and pine tar applied to act as a repellent for flies. Tannic acid dusted over the wound will check bleeding and make it less attractive to flies. The former extensive use of calomel in wounds is now practically discontinued.

REAKES (C. J.). **Notes regarding Ticks found on Farm Animals in New Zealand.**—*Jl. Agric. Wellington, N.Z.*, 1918. Feb. 20. Vol. 16. No. 2. pp. 83–86.

The ticks which transmit bovine piroplasmosis in Queensland and North America [*Margaropus* (*Boophilus*) *annulatus australis*, and *M. annulatus*, respectively,] have never been discovered in New Zealand.

The ticks that occur on cattle are *Ixodes ricinus* (commonly called the "dog tick" or the "castor bean tick") and a species of Haemaphysalis. Although piroplasmosis or any other serious trouble caused by ticks does not exist among cattle in New Zealand, yet the experience of other countries goes to show that ticks may be the source of trouble to stockowners in the future inasmuch as they occasion loss of condition, decrease in the milk yield, deterioration in the value of hides, and mortality among animals already weakened by various forms of sickness, insufficient food, or other causes. Measures are thus advised for their eradication. It is recommended that the infested parts of the skin should be sprayed with Stockholm tar after which all dead ticks should be collected and burned. Other spraying preparations tried and found to be somewhat less effective consisted of kerosene ½ pint, linseed oil ½ pint, and sulphur 1 ounce; or kerosene 10 ounces, lard 10 ounces, tar 2 ounces, sulphur 1 ounce. Very strong solutions of sheep dips also proved effective but cattle were liable to suffer from their effects when used at the necessary strength. Dipping is the only effective method available in the case of cattle unaccustomed to handling.

HILL (G. F.). **Some Notes on the Bionomics of the Buffalo-Fly (*Lyperosia exigua*, Meij.).**—*Proc. Linn. Soc. N.S.W. Sydney.* 1917. Apr. 4. Vol. 41. No. 164. pp. 763–768. With 1 plate. Abstracted in *Rev. App. Entom.* 1918. June. Vol. 6. Ser. B. Part 6. pp. 118–119.

"*Lyperosia exigua* (buffalo-fly) is a more formidable pest to cattle and horses in northern Australia than the larger and more voracious blood-sucking flies, owing to the greater number of individuals and the longer period of their seasonal occurrence. During the early part of the wet season (November and December) certain Tabanids, especially *Tabanus nigritarsis*, Tayl., cause greater annoyance and loss of blood than buffalo-flies, but their wounds heal without showing signs of inflammation, while the attacks of *Stomoxys*, *Lyperosia*, *Musca* and other flies cause characteristic sores.

"Old and sickly horses and cattle are most commonly attacked, goats are rarely molested, while dogs, pigs, sheep and kangaroos appear to be immune. The parts attacked are chiefly the belly, brisket, underparts of the neck, flanks and about the eyes. Buffaloes, both domesticated and wild are habitually infested, and man is occasionally bitten while riding fly-infested horses.

"This pest was probably introduced with stock from the East Indies subsequent to 1824, its present distribution in Australia coinciding fairly well with that of the introduced buffaloes.

"The eggs are laid singly to the number of 12 to 20 in dung or foul mud, the larvae, which emerge in 18 to 20 hours, burrowing into the dung, where they pupate after 3 or 4 days. The adults appear after a pupal period of 3 to 5 days, and seek their hosts, resting during the heat of the day and at night upon the flanks and withers of horses and about the horns of cattle.

"Natural enemies of the fly are few, insect predators being chiefly certain species of ants that gather the eggs for food, especially *Solenopsis geminata*, F., var. *rufa*, Sud., *Iridomyrmex detectus*, Smith, and *Odontomachus ruficeps*, Sm., var. *acutidens*, Forel. A more important enemy is a small Hymenopteron, *Sericophorus relucens*, Sm., which captures the flies while feeding or at rest.

"Artificial control over the immense and thinly-populated grazing areas would be obviously impracticable, but the frequent removal of manure from milking-pens and cow-yards would prevent these places acting as sources of infestation."

VAN ZWALUWENBURG (R. H.). **Cattle Ticks.**—*Report of the Porto Rico Agric. Exp. Sta.*, 1916. pp. 25–26. With 1 plate comprising 2 figs. 1918. Washington: Govt. Ptg. Office.

"Two varieties of ticks infest cattle in Porto Rico. The more common is the Australian tick (*Margaropus annulatus australis*). The typical *M. annulatus* of the Southern States is also present, but in much smaller numbers.

"Control of the tick by starvation or dipping is dependent for success upon an exact knowledge of the parasitic and nonparasitic development of the acarid in the locality in which control work is to be done. This work is well under way, and data are being collected on the variation of the stages during the different seasons of the year.

"At Mayaguez the Australian tick required 20 to 22 days for its development on the host during the fall months. Hence, if local eradication of the tick is attempted, applications of dips, sprays, or smears should be renewed about every three weeks to prevent the maturing of fresh generations. The minimum egg period under natural conditions was found to range from 36 days, beginning in February, when the average mean temperature was 74·7° F., to 23·5 days in September, when the average mean temperature was 79·6° F. The maximum starvation period of ticks hatching in April was found under natural conditions to be 94 days. Seed ticks protected from rain and direct sunlight had a maximum starvation period of 108 days."

BACTERIAL DISEASES.

MORRIS (Harry). **Blood-sucking Insects as Transmitters of Anthrax or Charbon.**—*Agricultural Experimental Station of the Louisiana State University and A. & M. College*, Baton Rouge. 1918. March. Bull. No. 163. 15 pp. With 2 text figs. & 3 tables,

In work carried out in the Louisiana Experimental Station for the past three years an attempt has been made to find out the relation between certain blood-sucking insects and the transmission of anthrax. Very few data concerning this subject are to be found in the literature on anthrax. SCHUBERG and KUHN (1912) transmitted anthrax from a carcase to a living animal through the biting of *Stomoxys calcitrans*. MITZMAIN (1914) in the course of an extensive piece of research work succeeded in transmitting the disease through the bites of *Stomoxys calcitrans* and *Tabanus striatus*. In Louisiana DALRYMPLE and DODSON (1900) produced strong circumstantial evidence to incriminate blood-sucking flies as vectors of anthrax by compiling a record to show the relationship between their prevalence and the occurrence of the disease.

Inasmuch as there appeared to be some unknown factor involved in the continuance and spread of several outbreaks in Louisiana Morris undertook a study of the most common blood-sucking insects of the country and by means of experiments on animals under as natural conditions as possible endeavoured to ascertain the rôle of the flies in the transmission of anthrax. The flies used were the horn fly *Haematobia irritans* L., a horse fly *Tabanus* sp. near *nigrovittatus* Macq., and the mosquitoes *Psorophora* (*Janthinosoma*) *sayi* D. & K., and *Aedes sylvestris* Theob.

The horn fly is one of the most predominant of all species of blood-sucking flies in Louisiana. It is prevalent during the greater part of the year and is found during the summer months in swarms feeding on cattle and more especially on those with dark coats to avoid detection. Numbers of these flies, varying from 100 to 300 for each experiment, were caught and confined in a wooden cage with a curved top covered with a fine wire screen. Great difficulty was experienced in keeping the flies alive in captivity owing to the fact that if left unfed for 12 hours they would practically all die, and thus frequent feeding upon a living animal was necessary. A guinea-pig which had been previously inoculated subcutaneously or intraperitoneally with a loopful of anthrax spores was tied on the wire screen of the cage and allowed to remain for one minute. Then after removing the animal the screen was disinfected with perchloride of mercury solution and a healthy guinea-pig fastened on the cage and allowed to remain from one to three minutes. The horn fly will usually feed from four to six minutes and so by this method the feeding was interrupted. From the results of a considerable number of experiments it was found that transmission of the disease to the healthy guinea-pigs commenced to take place when the flies were allowed to bite infected animals four hours before death (11 per cent. of cases) and the percentage of positive results became increasingly higher until within a few minutes before death (54 per cent. at 30, 50 per cent. at 15, 55 per cent. at 5 minutes before death); at death transmission took place in 33 per cent. of cases, 15 minutes after death in 10 per cent., while 30 minutes after death the results were all negative. In some cases the internal form of anthrax was produced but in the majority the external or carbuncular form was most common. The guinea-pig died at any time from 48 to 82 hours after having been bitten by the flies.

A few experiments were conducted in which an appreciable period of time elapsed between the feeding on the infected host and the susceptible animal; the results were negative in all cases.

In a series of experiments in which an infected sheep was used as the source of infection one guinea-pig out of two became infected when the flies had fed on the sheep 30 minutes before death, and in all cases where the flies had fed 15 minutes before death, at death, and 15 minutes after death (nine guinea-pigs used altogether in these experiments).

In the experiments with the horse fly, Tabanus sp., small glass jars covered with wire gauze were used, one fly being placed in each jar. This fly appears in great numbers during the latter part of August and in September, and bites with great avidity in captivity. The fly was allowed to bite the abdominal surface of an infected guinea-pig, and then as soon as it had commenced to feed the jar was transferred in a similar manner so as to come into contact with the abdominal surface of a healthy guinea-pig. If after contact with the infected animal the metal cap became soiled with blood it was replaced by a clean one before the fly was allowed to feed on the uninfected animal. In these experiments positive results were obtained in all cases where the flies were allowed to bite the infected animals at intervals from four hours before death (16 per cent.) up to the time of death (100 per cent.); when allowed to bite

16 minutes after death the positive results amounted to 16 per cent., and 20 minutes after death 0·0 per cent. The flies would not feed satisfactorily on the dead body of a guinea-pig.

Under field conditions another species, a black horse fly, *Tabanus atratus* Fab., sometimes feeds on dead bodies 30 minutes or more after death. Virulent cultures of anthrax were obtained from the bites of these flies that had fed upon the carcase of an animal dead of anthrax. The flies could not be induced to feed in captivity although a great number were collected and a different technique used. It is quite common during the fly season to see blood dropping from the bellies of horses and mules due to the biting of various species of Tabanus and in this manner anthrax could be spread from animals suffering from the disease.

In the case of mosquitoes a similar technique to that adopted in the case of the horse flies was used and positive results (16 per cent.) were obtained when the flies were allowed to feed three hours before death. The number of positive results increased up to 70 per cent. when biting took place at the moment of death, 10 minutes later 12 per cent. transmissions were obtained and 30 minutes after death nil.

A number of observations were made with regard to the presence of anthrax bacilli in the excrement of the above named insects. Small bottles were used as retainers for the insects as in the case of the horse fly experiments described above. Some difficulty was experienced in inducing single horn flies to feed and so a dozen had to be confined in a bottle until they had fed and then they were placed in separate bottles. After the flies had fed until engorged with blood, which was shown to harbour large numbers of anthrax bacilli, the bottles were allowed to stand and cultures made each day from the "specks" deposited on the surface of the glass. 1,218 specks from the horn fly were cultivated and 11 produced colonies of anthrax; the positive results were obtained within six hours after feeding upon the infected host. Two colonies of anthrax were found in 318 specks from the horse fly, positive results being obtained within 12 hours after feeding, and one colony of anthrax was found in 711 specks examined from the mosquito (the one positive result being obtained between the 48th and 72nd hour after feeding).

These results would indicate that anthrax bacilli are mostly if not entirely destroyed in the digestive tracts of the above described insects when ingested in the blood of an animal affected with anthrax. It is suggested that the few colonies found might have been produced from the contaminated feet and bodies of the insects. No attempts were made to feed anthrax spores to see if they would pass through the digestive tract.

JENSEN (H.). **Hemorrhagic Septicemia, its Clinical Diagnosis.**—*Jl. American Vet. Med. Assoc.* 1918. Oct. Vol. 54. New Series. Vol. 7. No. 1. pp. 39–47.

In this paper the author gives a concise account of the various clinical manifestations in haemorrhagic septicaemia observed in the course of his experience in Texas. It is there stated to be attended with high mortality and attack various species of animals especially cattle, sheep, and swine. Young animals are more susceptible than

adults and animals in poor condition are most liable to be affected. The clinical diagnosis in many cases is exceedingly difficult and can only be arrived at conclusively by laboratory examination, which may necessitate the adoption of experimental animal inoculation. Swine plague caused by a Pasteurella organism alone is very rarely encountered in the field and nearly always represents a mixed infection. Fowl cholera representing the avian form of the disease sometimes causes great losses.

From the point of view of symptomatology and morbid anatomy haemorrhagic septicaemia may be manifested under one or other of the following forms:—(1) pectoral or pulmonary, (2) subcutaneous, (3) cutaneous, and (4) enteric form.

In the pectoral form the period of incubation varies from six hours to eight days, and the symptoms are those of a rapidly developing acute pleuro-pneumonia. On section the lungs are hepatised and show serous infiltration of the connective tissue and the affected portions often present a marbled appearance as seen in contagious pleuro-pneumonia.

In the subcutaneous form swellings appear beneath the skin of the head, throat or dewlap, which are somewhat soft and pit on pressure. The tongue is often swollen and there is marked salivation. Swellings of the legs or various joints may also be observed. On post-mortem examination haemorrhagic areas are found in the subcutaneous tissue, varying greatly in number and in size; in some cases they are so extensive as to involve up to one eighth of the body surface. These areas are infiltrated with a sero-fibrinous exudate usually yellow in colour but sometimes dark red. Minute haemorrhages are found in the muscle tissue. The lymphatic glands are frequently though not uniformly enlarged, the cervical and prescapular glands being most seriously affected.

The cutaneous form, originally called "mad itch," is of rare occurrence and usually manifests itself by the animal showing intense itching and nervousness. Large areas of skin may thus be entirely devoid of hair and rubbed to a raw sore. The animal usually dies in from 12 to 72 hours. This form is often difficult to differentiate from rabies and other cerebral conditions, but on blood examination typical bi-polar staining organisms are discoverable. On post-mortem examination no distinct lesions are often found but there are usually petechiae in the subcutaneous tissues and in the muscle and fat at the base of the heart; none are to be found over the ventricles towards the apex, however, as is often found in other forms of the disease. Haemorrhages occur in the meninges of the brain and spinal cord, and the cerebro-spinal fluid is more or less red in colour.

At times the changes are found chiefly in the abdominal cavity and this form of the disease may occur after it has developed in the lungs. It is usually accompanied by symptoms of colic and severe straining. The animal finally becomes affected with a thin foetid diarrhoea frequently mixed with flakes of fibrin and mucus and blood clot. Sometimes the faeces may be apparently normal except for the presence of blood streaks, but on the other hand the mucous membrane of the intestine may be so badly inflamed that large portions of it are expelled with the faeces, and the excreta in this condition may have the appearance of pure blood. In certain districts

this form is very rarely encountered. On post-mortem examination pronounced inflammatory changes are noted in connection with the digestive tract.

In sheep, young animals that have just been weaned are most susceptible, the disease manifesting itself in an acute form; there is high temperature, muscular tremblings, discharge from the eyes and nose and colicky pains. The duration of the disease is usually very short although it may become a chronic infection of the lungs with gradual emaciation of the animal. The disease in many instances is of such an acute nature that no distinct changes are seen post-mortem except for petechiae in the heart, lungs, and spleen and congestion of the lymphatic glands.

In swine the disease sometimes manifests itself in an hyperacute form with the symptoms of a general septicaemia. Red spots may be noted on various parts of the body. The disease may also occur as a necrotic pleuro-pneumonia and the symptoms and lesions in many cases are identical with those of hog cholera.

In cattle the disease has to be differentiated clinically from anthrax, blackquarter, malignant oedema, and rabies.

DISEASES DUE TO FILTERABLE VIRUSES.

SCHERN (Kurt) & VON BARTAL (Robert). **Ueber Rinderpest (Zweite Mitteilung). Ueber Rinderpest-Blutbefunde nach Braddon.** [The Structures described by Braddon in Rinderpest Blood.]—*Ztschr. f. Infektionskr . . . d. Haustiere.* 1918. Sept. Vol. 19. No. 4. pp. 293–305. With 1 text fig.

In 1913 BRADDON (W. L.) described the appearance of "some peculiar and probably specific bodies in the erythrocytes in rinderpest and another allied disease" in the course of his observations in connection with the production of a protective serum for buffaloes in the Malay States [see this *Bulletin*, Vol. 2, No. 1, pp. 45–47]. When rinderpest infected blood was diluted from three to five times its volume of a watery solution of one per cent. potassium citrate and 0·5 per cent. methylene blue there appeared, on examination after a period varying from 6 to 48 hours, upon the blood corpuscle a blue point from which one or more delicate radiating fine lines later developed. These radiate bodies were sometimes found to be completely extruded from the corpuscles. They were said also to exhibit twisting or rotatory movements and these movements were imparted to the corpuscles within which they were included. The bodies were stated to be invariably discoverable in all cases of acute rinderpest during the febrile stages and in the great majority of cases up to eight months after recovery. A somewhat different kind of intra-corpuscular body was described in the case of buffaloes suffering from a disease resembling a mild form of rinderpest. A method was described by means of which the bodies could be stained after fixation.

A number of observations made by JOHNSON (J. C.) on blood corpuscles from various other mammals in a normal state of health or suffering from other protozoan blood infections appeared to lend confirmation to BRADDON'S observations [*loc. cit.*, pp. 47–48]. It is interesting to note that MARTOGLIO, in the course of observations

on cattle affected with rinderpest in Eritrea, failed completely to demonstrate the specificity of the above bodies—a reference overlooked by the above authors [this *Bulletin*, Vol. 5, No. 3, p. 195]. Du Toit (1916) in a critical review of the recent literature dealing with rinderpest notes that Braddon's method of mixing blood with an anisotonic solution over a more or less prolonged period constitutes a by no means delicate test, although he himself by following the technique recommended by Braddon with a number of healthy German cattle failed to demonstrate bodies such as were described by that author.

In the course of their work in connection with the production of anti-rinderpest serum at the Pendik Institute in Asia Minor Schern and von Bartal tested the accuracy of Braddon's observations with the blood of animals used for virus production. A number of experiments were made in which the technique recommended by Braddon was closely followed and also the effect of employing solutions of methylene blue alone and of potassium citrate alone and in various dilutions ($\frac{1}{2}$ to 2 per cent.) was tested on the bloods of rinderpest-affected and normal cattle, and also of the sheep and horse.

As was to be expected it was found that on allowing the mixtures recommended by Braddon to stand in a test tube the corpuscles tended to settle to the bottom of the tube and thus only the upper layers of the corpuscles came into intimate contact with the staining solution. It was frequently seen that varying appearances were presented by the corpuscles when they did not form a uniform suspension in the fluid. After allowing the mixtures to stand one therefore on examination at various intervals noticed corpuscles that were unchanged in appearance and corpuscles presenting varying degrees of abnormality; the corpuscles taken from the upper layers showed the so-called Braddon's bodies while those from the deeper layers remained free. The various stages in the development of these bodies could thus be followed.

The anisotonic condition of the staining solution also produced various changes in the corpuscles such as the appearance of wrinkles, projections, etc. It was noteworthy that the so-called Braddon bodies were only observed in deformed corpuscles. In no case was a linear body observed to develop out of a punctiform body. It was also striking that the appearance of the so-called Braddon bodies could be brought about by the employment of a solution of potassium citrate alone, whilst they could not be set up by the employment of methylene blue alone. The bodies were demonstrable in the blood of normal animals as well as in that of rinderpest-affected cattle. As the result of their experiments the authors conclude that Braddon's so-called specific rinderpest bodies are simply the products of reaction between the red corpuscles and certain chemical substances especially potassium citrate, and judging from observations on Anatolian cattle they are not specific for rinderpest.

Lagaillarde. **Note sur le sérum virus dans la peste bovine. Immunisation dans le Niani-Ouli.** [Sero-Vaccination against Rinderpest in the Niani-Ouli Region, French West Africa].—*Gouvernment Général de l'Afrique occidentale française.* 1918. Feb. 18. pp. 12. Gorée: Imprimerie du Gouvernemen général.

In this note the author gives an account of the methods adopted by him together with the apparatus necessary for the production

of an effective anti-rinderpest serum in the field. The doses administered were 20 c.c. of blood or 10 c.c. of serum. Prior to the use of serum as a prophylactic the mortality in the district had risen to 80 per cent. but after the adoption of sero-vaccination it is said that there was a very striking decrease in the mortality.

Out of 1,375 animals belonging to infected herds, inoculated by means of either fresh, carbolised, or glycerinated bile the losses were 38 per cent. ; out of 2,195 animals inoculated in a clean area the losses were 8·04 per cent. In the infected areas only the cattle showing no clinical symptoms were inoculated. The high losses are probably attributable to a large extent to the fact that many of these animals were inoculated during the incubation period of the natural disease.

Di Domizio (Giovanni). **Interno alla profilassi della peste bovina in particolare e alla lotta conro i morbi infettivi del bestiame in generale in Colonia Eritrea.** [Prophylaxis of Rinderpest in Particular and Control of Infectious Diseases of Animals of Eritrea.]—*Moderno Zooiatro.* 1918. Jan. 31 to May 31. Vol. 7. Nos. 1–5. pp. 20–24, 35-48, 60–72, 84–96 & 107–120.

The author's observations on rinderpest carried on in Eritrea in 1912 and 1913 lent confirmation to the view expressed by Zonchello [see this *Bulletin*, Vol. 5, No. 2, pp. 127–128] that the ultimate effect of Kolle and Turner's so-called "simultaneous" method was to bring about invariably the further spread of the disease without exercising any prophylactic action.

This result was not the outcome of a defect in the method as suggested by Zonchello but was attributable to the fact that it was never possible to carry out the details set forth in the official programme laid down in 1905 relating to immunisation of all cattle within a short period of time by means of the method. By that means it should have been possible to obviate any risk of spreading the disease as a result of the sero-vaccination itself. The process instead was always carried out in a partial manner with the result that at least half the bovine population remained susceptible to the disease on each occasion; adequate safeguards were not set up to prevent these animals running any risk of infection originating from the centres under treatment.

In the control of rinderpest in Eritrea the simple ordinary measures of sanitary police (isolation, disinfection, etc.) without active immunisation of cattle will succeed, if they are rigorously applied, in limiting the losses due to an enzootic, but only for a more or less short period of time, that is to say, whilst there are no acute recrudescences of the disease. When, after a few years an area rendered partly or wholly clean by the application of the above police measures becomes completely or almost completely susceptible to infection, then simple sanitary police measures in themselves would not be capable of safeguarding the Colony from an invasion, with disastrous results, of rinderpest from Abyssinia owing to the topography of the Eritreo-Ethiopian border and the diffusibility and severity of the disease.

Of all the actually known means of dealing with rinderpest, active immunisation by Kolle and Turner's method is still the one most strongly indicated in the case of Eritrea, in conjunction with the application of strict sanitary police measures. But, in order to obtain

some real advantage from the fact that the method leaves an immunity lasting throughout the whole lifetime of inoculated animals and in order to eliminate its inherent disadvantage, namely, its liability to spread the disease among susceptible uninoculated cattle, the whole bovine population of Eritrea should be subjected to sero-vaccination within the shortest period of time; special precautions should be taken in dealing with the border lands and the inoculations should be repeated every three or four years so as to immunise all cattle born during the intervals and each time the operations should be completed within a period of a few months. In the carrying out of such a programme the production of serum in sufficient quantity would present no real difficulty, for when it had become impossible to produce it within the Colony on account of the deficiency of virus and susceptible cattle following upon the primary general immunisation there would be nothing to prevent its further production in Abyssinia. The essential conditions thus are

(1) that the sero-vaccination should be performed gratuitously; that is, preferably without direct payment, but expenses should be met by an increase in the present tax on cattle;

(2) that a veterinary police service should be organised comprising six veterinarians for each regional commissariat according to the extent of their territory, three or four for Abyssinia, and a like number for administration and serum production.

From an economical point of view such a system of prophylaxis should add at least from 10 to 11 per cent. to the value of the cattle for the native population. These figures must undoubtedly be increased when one takes into account the slight loss in milk, work and meat-producing capacities during the short period following on vaccination compared with that suffered from in the natural disease; the method would, in addition, stimulate the production of cattle among the natives in greater numbers and of better quality.

The danger of transmitting disease of a more or less serious nature by the inoculation of protozoan parasites—which led Koch and Theiler to condemn the method—can be invariably avoided in Eritrea if the operations are undertaken by competent persons. The author is particularly insistent upon this point inasmuch as he bases his experience on the inoculation of about 80,000 cattle carried out during a period of 18 months under very difficult circumstances and whilst he had not always got at hand a really effective anti-rinderpest serum.

By means of sero-vaccination against rinderpest it would be possible to carry on a very important political programme in the interior of Abyssinia.

The veterinary police organisation would be invaluable in Eritrea not only for prophylaxis of rinderpest whatever method might be adopted (active immunisation and sanitary police, or sanitary police alone) but also for the control of the other contagious diseases existing in the Colony and to prepare the way for improvements in breeding.

When by means of sanitary police and improved breeding a surplus of cattle had been produced in Eritrea exportation of frozen or preserved meat to Italy could take place. But the importation of live animals into Italy should never be countenanced, especially on account of the risk of introducing contagious diseases.

KAKIZAKI (Chiharu). **Study on the Glycerinated Rinderpest Vaccine.** —*Kitasato Arch. Exp. Med.* 1918. May. Vol. 2. No. 1. pp. 59–66. With 5 tables.

Rinderpest has not appeared in Japan since 1909, but the country is now exposed to danger on account of the commercial relations existing between it and China. The author's experiments, involving the inoculation of Korean cattle, which are said to be highly susceptible, were aimed at attenuating or " debilitating " the virus so as to render it fit for vaccination purposes. He states that TAKAZAWA was the first to claim to have diminished the virulence of the virus by passing it through the bodies of pigs. By subjecting the infected tissues and fluids (spleen and defibrinated blood) of cattle that had succumbed to the disease to the action of glycerine the author claims to have successfully attenuated the virus. It could not, however, be preserved for long in this state, and sometimes it showed a tendency to revive. The proportion of glycerine added to the defibrinated blood in these cases is not indicated. No dangerous ill effects were produced upon the inoculated animals. The length of time the above materials were found to harbour the virus in their " debilitated " or attenuated form was found to vary considerably with the temperature. For example, defibrinated blood retained its virulence for 10 days at room temperature while at temperatures below freezing it was found unchanged after 55 days but quite avirulent in 80 days. The avirulent virus contained in the emulsion of glycerinated infected spleen appeared to retain some antigenic properties, even when the immersion in glycerine has been continued for over a year.

REMLINGER (P.). **Sur la présence du virus rabique dans la rate.** [The Presence of Rabies Virus in the Spleen.]—*Ann. Inst. Pasteur.* 1918. Aug. Vol. 32. No. 8. pp. 406–412.

BABES appears to be the only investigator who succeeded in transmitting rabies by the inoculation of material from the spleen; the spleen of one rabbit out of six experimented on in this way proved virulent. Nevertheless the presence of inflammatory and sometimes even necrotic nodules in the spleen in certain cases of rabies in man and other animals led this author to believe that the organ harboured in some cases the virus, which might thus set up lesions analogous to those found in the nervous centres. With this exception all the observations described in medical literature disclose negative results.

Remlinger carried out a series of experiments with the spleens of guinea-pigs that had succumbed to rabies, in a manner similar to that described in his previous contributions to the study of rabies [see preceding number of this *Bulletin*, p. 181]. From these experiments he considers himself justified in concluding that the rabies virus may be encountered much more frequently in the spleen than has been hitherto recognised. Its presence was revealed eight times in the course of 42 experiments and was proved to be quite independent of post-mortem generalisation inasmuch as 12 guinea-pigs slaughtered just before death would have naturally taken place furnished three positive results. This result must be attributed apparently to the

fact that the virus may be found much more frequently in the blood than writers have admitted. MARIE (A.) has already drawn attention to this point, which the author proposes to investigate afresh. Instead of tending to favour the diffusion of the virus in the spleen the onset of putrefaction seems in the first place to render it less frequently discoverable (spleens of animals sacrificed before natural death—3 positive results in 12 experiments; spleens of animals post-mortemed within 12 hours after death—3 positive results in 12 experiments; spleens of animals post-mortemed at longer intervals than 24 hours after death—2 positive results in 18 experiments).

A comparison of these results is, however, somewhat illusory on account of the fact that it is impossible to resort to sub-dural inoculation after the onset of putrefaction and the infection following on intramuscular inoculation is of an appreciably lesser degree of severity.

HECKENROTH (F.). **Contribution à l'étude de la rage en Afrique occidentale Française.** [Rabies in French West Africa.]—*Ann. Inst. Pasteur.* 1918. Aug. Vol. 32. No. 8. pp. 389–398. With 1 map.

The presence of rabies in the dog has been described in French West Africa by CAZALBOU and BOUFFARD in the Sudan, TEPPAZ and BOURRET in Senegal, and ALDIGÈ in Guinea. The disease was said to be intermediate in type between the furious and paralytic forms, with paralytic phenomena predominating. In most cases these authors succeeded in transmitting the disease to the rabbit, dog, and guinea-pig by intra-cerebral or intra-ocular inoculation of emulsion from the rabid brain, causing death in three or four weeks with complete paralysis.

BOUFFARD (1909) showed that the disease was transmissible through rabbits in series, in which animals death was produced after a somewhat variable interval (from 15 to 20 days usually, up to 35 to 38 days) and one rabbit out of every six proved refractory after inoculation. He also stated that canine rabies in the Sudan did not appear to be transmissible to man in natural conditions inasmuch as no case of human rabies had been observed in that country where mad dogs were by no means rare. In addition, rabies is not considered to be transmissible from dog to man in Senegal, Guinea, Dahomey, and the Hausa country. The records of the French Medical Service in West Africa during the thirty years prior to 1915 contain a description of only one well authenticated case of human rabies.

As the result of the death of five natives following on bites from a native dog a month and a half previously the author carried out some interesting investigations at the Dakar laboratory during 1915–1916 on animals suspected of having become infected with rabies. These comprised 12 native and three European dogs and one wild jackal forwarded from various regions. Seven of these animals were slaughtered, seven succumbed to the disease, while two were lost. The slaughtered dogs were for the most part wandering dogs and did not apparently show any sign of paralysis but were furious or dejected and bit men and dogs that came in their way. The course of the disease was followed in the case of six dogs and the jackal. Six of these

animals died after having shown dejection, excitability, and modified laryngeal sounds. Human beings or dogs were bitten by four of these animals and paralysis was observed in five instances. In the 16 small investigations undertaken it was established that in three cases the rabid dog had bitten animals or man, in five cases man only, in four cases dogs only, and in four other cases both man and dogs. The exact number of human beings bitten could not be ascertained but six Europeans and 25 natives succumbed to the disease. However, the bites of three of the rabid dogs did not give rise subsequently to rabies though the subjects bitten were kept under observation for more than eight months. Three dogs and a jackal also did not transmit rabies to the persons bitten but anti-rabic treatment was adopted in these cases. Two dogs bitten by two of these animals failed to contract rabies but symptoms were presented by six dogs bitten by three of the other cases. A number of laboratory experiments were made on material obtained from these cases and attempts were made to transmit the virus in series through the rabbits.

The observations made by the author would thus appear to indicate that there exists in Senegal a recently imported rabies virus, responsible for the epidemics among Europeans in 1915, in addition to the already well-known native virus, identical with that of the Sudan inasmuch as it is not transmissible by the bite of a dog to man. Although this hypothesis is supported by the history of certain of the outbreaks it seems on the other hand improbable that a carrier of the foreign virus should not have transmitted its disease to another dog in a country where street dogs are considerable in number and canine rabies is of as frequent occurrence as formerly. Although no rabbits were found to be immune towards infection with the fixed virus of the Pasteur Institute maintained at the Dakar laboratory the virus isolated in 1915 in Senegal and BOUFFARD's Sudan virus did not always prove to be virulent. Out of 27 rabbits inoculated with fresh brains containing Negri bodies three remained unaffected. BOUFFARD likewise noted a proportion of refractory animals of one in six. It may be that the native West African virus is capable of becoming exalted in certain circumstances. One virus examined by the author showed no tendency to assume a so-called " fixed " character, a fact already remarked upon by BOUFFARD in the Sudan.

EQUINE INFECTIOUS ANAEMIA.—The following letter has been received from the Director of Quarantine, Commonwealth of Australia:

Melbourne,
28th August, 1918.

Dear Sir,

I desire to invite your attention to an article which appeared in Volume 5, Number 4, Page 257 of the " Tropical Veterinary Bulletin," December, 1917, under the heading " Diseases due to Filterable Viruses," in which a report by Sohns (J.C.F.) and Soetedjo (Raden) on an outbreak of Equine Infectious Anaemia in Dutch East Indies, is reviewed. From the article it appears that the investigators of the outbreak hold that Australian horses are responsible for the occurrence of the disease, and it is stated that the disease " is believed to have been imported undoubtedly from Australia."

2. Full inquiries have been made from the State Veterinary Authorities in all the Australian States, and the official records have been searched with the view of ascertaining whether the disease has ever occurred in Australia. These inquiries have made it perfectly clear that Equine Infectious Anaemia does not, and has never existed in Australia.

3. As the statement, if allowed to go unchallenged, is likely to prejudice the export trade of horses from Australia, I should be glad if you would kindly publish a statement to the above effect.

Yours faithfully,
(Signed) J. H. L. CUMPSTON, M.D.,
Director of Quarantine.

The Editor,
Tropical Diseases Bulletin.

MISCELLANEOUS.

SELLARDS (Andrew Watson). **Investigations of Tropical Sunlight, with Special Reference to Photodynamic Action.**—*Jl. Med. Res.* 1918. July. Vol. 38. No. 3. pp. 293-334.

The following is the author's summary :—

"The discovery by Raab in 1898 of photodynamic action has given considerable impetus to the study of biological effects of sunlight. Although many of the fundamental conditions of photodynamic action have been worked out, the phenomenon has not yet been accurately defined. It is, however, easy to give a simple illustration. Very many fluorescent substances, such as eosin, chlorophyll, or several of the blood pigments, are capable of dissolving red blood cells in the sunlight under conditions in which no hemolysis occurs in total darkness. Photodynamic action is associated closely, though perhaps not invariably with the property of fluorescence. Phenomena analogous to those occurring in vitro can be produced in animals, many fluorescent substances being toxic for animals kept in the light, but not for those in total darkness.

"Certain clinical effects have been attributed to this action of light intensified by fluorescent substances. In buckwheat poisoning, some of the symptoms ordinarily ascribed to anaphylaxis are attributed by European authorities to photodynamic action. Some of the diseases of man, notably pellagra, are considered to be instances of photosensitization, i.e., that fluorescent substances ingested with the food subsequently, with the aid of light, produce toxic effects. The therapeutic action of some drugs, notably quinine, has been ascribed to fluorescent action. However, the therapeutic effects of direct sunlight have not been definitely improved by the use of fluorescent substances.

"The toxic effects described for buckwheat, corn and other grains might be of primary importance in studies of nutrition, except for the fact that many high y photodynamic substances do not exhibit toxic effects when ingested in the alimentary tract. The symptoms occurring in various "deficiency diseases" are ordinarily interpreted as being due to a lack of dietary factors essential for normal nutrition. In addition to the effect of a deficient nutrition the possibility of toxic action is introduced in the conception of photodynamic action. Fortunately, many of the important feeding experiments on lower animals have been conducted in dull, diffuse light, a condition in which the action of light would hardly affect the general fundamental conclusions.

"Several phases of the effects of light and of photodynamic action were studied in the tropics at Santa Marta, Colombia. Confirmation was readily obtained of the photodynamic action of eosin on red cells in vitro. A similar effect could not be obtained with quinine. A trace of hemolysis was obtained by the action of sunlight alone without the aid of fluorescent substances. Complement, though readily destroyed by direct sunlight,

was apparently uninjured by the diffuse light of the laboratory. Malarial parasites in defibrinated blood were not affected by exposure to direct sunlight. Diffuse light, however, exerted some deleterious action on *E. histolytica.*

"Anaphylaxis of guinea-pigs to horse serum was studied rather extensively. Typical fatal effects were obtained in animals kept in total darkness. Quantitative results, however, suggested the possibility that exposure to light during the period of sensitization may increase slightly the susceptibility of the animals. Similar results were obtained in the study of local anaphylaxis.

"No evidence was obtained, either from experiments in vitro or in vivo, that the therapeutic effect of quinine in malaria is dependent on its fluorescence, i.e., that quinine is effective only in the presence of light.

"A preparation of bilirubin was tested and found to act photodynamically in vitro in producing hemolysis and in the prevention of the clotting of blood.

"In conclusion, there are certain features which it might be well to emphasize. Photodynamic action in vitro constitutes a remarkable phenomenon, the explanation of which is perplexing and obscure; some of the cardinal features are still in dispute. There is even a possibility that undue emphasis has been laid upon the association of fluorescence with photodynamic action. The phenomenon is of very general interest since its effects may be studied not only in many distinct ways, but in several different fields of work, such as bacteriology, protozoölogy, immunology, and organic and inorganic chemistry. Indeed, a knowledge of photodynamic action is essential in certain fields of work; to a limited extent, the question of the possible effect of light is reopened in some instances where it had been taken for granted that ordinary diffuse light could exert no action.

"In contrast to the multiplicity of effects observed in vitro it is often difficult even experimentally to demonstrate photodynamic action in the animal body. It is by no means thoroughly established that sensitization to light in a photodynamic sense occurs spontaneously, even in the lower animals. As yet there is very little evidence indeed that such sensitization plays any significant part, either in the etiology or therapy of the diseases of man. The subject, however, is comparatively undeveloped, and certainly merits further effort. The field is not one which would yield at all readily results of first importance. Indeed, it is not yet clear from what general direction one might expect significant developments."

HECKENROTH (F.). **Trois observations d'une affection non classée du chien au Sénégal.** [Three Observations on an Unclassified Disease of the Dog in Senegal.]—*Ann. Inst. Pasteur,* 1918. Aug. Vol. 32. No. 8. pp. 399–405.

In this article the author describes five cases of a disease in dogs from the Kaolack and Rufisque districts of Senegal which came under his observation in 1916. Three of these animals were kept under observation at his laboratory after having been bitten in these districts. In all five cases the disease was fatal and lasted from 3 to 27 days after the appearance of first symptoms. The disease became manifest at first by a strange appearance of the animal and paralytic symptoms, more or less marked in the case of the limbs and accompanied with muscular contraction. In the case of one dog there was no apparent paralysis, the animal assuming a sitting position two hours before death. In two cases there was abundant salivation and in two cases in which the disease developed slowly the nervous symptoms appeared to become less accentuated several times for a few hours or a few days and the general condition meanwhile improved. The animal seemed to be able to feed up to a very advanced stage of the disease.

It was not possible to say whether the infection was contagious—transmitted by a biting fly or merely by the bite of another affected animal. The last-named method of infection appeared to have taken place in the case of two dogs from Rufisque which developed symptoms 15 days after having been bitten.

Laboratory examinations, carried out in order to ascertain the presence of rabies, gave no positive evidence whatever on this point. Negri bodies were not discoverable in the hippocampi of four dogs examined. In paralytic rabies, however, it is not rare to find them altogether absent from this part of the brain and they must be looked for in the spinal cord and its ganglia. This method of examination was adopted in the case of one dog from Rufisque and in the nerve cells of the posterior root ganglia of this animal there were cellular inclusions coloured deeply red by Baschieri's method. Whether these bodies were so-called spherulae described by ATHIAS (1905) and CESA BIANCHI (1907) in the dog, rabbit, and guinea-pig or minute Negri bodies requires further investigation.

Three rabbits out of four inoculated with emulsion of brain from affected dogs died. Two monkeys which were bitten in the laboratory by affected dogs showed no abnormality after more than eight months observation.

STOCKMAN (Stewart). **Louping-Ill.**—*Jl. Comp. Path. & Therap.* 1918. Sept. Vol. 31. Pt. 3. pp. 137–193. With 10 text figs.

Although this article is not concerned with a tropical disease an extract is here inserted. It is of great general interest inasmuch as an obscure ovine affection has been proved to be transmitted by the agency of ticks and caused by organisms probably of a protozoan nature, and thus it falls into line with a class of diseases hitherto considered to be pre-eminently peculiar to warm climates.

In a previous article (*Jl. Comp. Path. & Therap.*, Vol. 29, p. 24) the author dealt mainly with the suggestion that ticks might play some part in producing louping-ill, and a very considerable series of experiments with ticks from affected sheep in different stages of their life cycle was recorded. All had apparently negative results but as there appeared to be strong indirect evidence that the disease was tick-borne a further carefully planned and carried out series of investigations was conducted. At the time of the preliminary experiments the only symptom regarded as typical of louping-ill was that of paralysis. Temperatures were not taken. On the other hand as visible symptoms were absent in all cases the experiments were probably negative and hence it remained to investigate further problems in connection with possible tick transmission. The author then proceeds to discuss in detail his observations regarding the symptomatology, post-mortem lesions, and experimental transmission of the disease. His conclusions are set forth as follows :—

"(1) In investigating a disease like louping-ill, the symptoms of which in naturally contracted cases may vary from those of indisposition to those of serious illness with fatal paralysis or coma, the milder form being much the more common, the experimental results must vary in the same way. It is therefore only by taking these results as a whole, and by being able to concatenate them with each other and with what occurs under natural conditions, that conclusions can be arrived at.

Fig. 1.

Fig. 2.

Fig. 1. Smear from œdematous lymph gland from Ewe 14288 (natural case, Experiment LXI). Stain Giemsa, + 600. *a.* Large and small chromatin bodies surrounded by blue-staining protoplasm. Appearance of division. *b.* Larger bodies of same kind containing a large number of chromatin bodies, some of which are bacillary. *c.* Chromatin bodies in small mononuclear cell. They are lying in a clear space, giving an appearance of being encysted. *d.* Chromatin bodies in large mononuclear cells. Notice the ring-like arrangement of the bodies around a clear space in the cell nearest the left. *e.* Small chromatin bodies in cell protoplasm and nucleus. *f.* Large and small chromatin bodies in large mononuclear cell. The nucleus has been partially destroyed. *g.* Rosette form and more open form.

Fig. 2. Blood smear from Wether 442 (experimental case, Experiment XC). Stain Giemsa, + 600. *a.* Large mononuclears showing small chromatin bodies in cell protoplasm. *b.* Chromatin bodies in nucleus. *c.* Larger chromatin bodies grouped in cell protoplasm.

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"(2) The juice of certain oedematous lymph glands and the blood from sheep affected with louping-ill when inoculated into other sheep can cause a disease which may be fatal or may amount only to an indisposition. This disease is characterised by high temperature, in some cases by coma, nervous tremblings or twitchings, or even paralysis, by an absence of macroscopic lesions capable of explaining the symptoms, and by the presence of microscopic lesions in the brain and cord of varying degree but referable to a pathological condition describable as myelo-encephalitis and similar to what are found in cases of naturally contracted louping-ill.

"(3) Notwithstanding the first apparently negative results obtained with ticks (*I. ricinus*) in various stages which had in a previous stage fed on sheep affected with louping-ill in the field (previous article), it follows from the later results . . . that larvae from females which as adults engorged on affected sheep can give rise, as in (2), to a highly febrile and sometimes fatal disease in other sheep, when put to feed upon them in very large numbers, and that adults fed as nymphs on affected sheep may have the same effect. It is possible that the apparently negative results recorded in the first article arose owing to the circumstance that only a small proportion of ticks become carriers of infection, but it is also probable that neglecting to take temperatures explains some of the apparently negative results.

"(4) The blood and the juice of oedematous lymph glands from cases arising from experimental inoculation as stated in (2) and from infestation by ticks as stated in (3) can cause similar symptoms and lesions when inoculated to other sheep in series. Ticks allowed to engorge on these experimental cases during the reaction can, after moulting to their next stage, cause the disease in other sheep upon which they are put to feed.

"(5) It follows from (3) that the infective agent, whatever it is, can be transmitted from the female ticks through the eggs to the next generation of larvae; but, although the positive results so far have been obtained with larvae and adults, it does not follow conclusively from the results available that the ticks in their nymphal stage cannot also transmit the disease.

"(6) Since the disease can be transmitted to sheep in series by inoculation it follows that the infecting agent is not a toxin, but a living agent capable of reproducing itself to some extent in the tissues of the animal into which it is inoculated. It also follows almost certainly from the fact of ticks transmitting the infection that the infective agent is a protozoan parasite. Some of the mononuclear leucocytes in oedematous glands and in the blood stream when treated by Giemsa's stain show in their protoplasm chromatin bodies which have some of the characteristics of protozoan parasites, including their staining reaction. It is not claimed, however, that a final statement can be made that these chromatin bodies are parasites, and the causal agent of louping-ill. Awaiting the results of further research on this special question, it is allowable to summarise the evidence in favour of the parasite view being correct: (1) The disease is tick-borne. (ii) Inoculation with the fluids and organs of sheep containing the bodies reproduces the disease. (iii) The bodies stain after the manner of such parasites. (iv) The causal agent is apparently not ultramicroscopic, and the bodies are the only abnormal objects observable under the microscope in materials which convey the disease by inoculation. (v) The virulent material, if perfectly fresh, is sterile as regards bacteria (the infective agent appears to be retained by bacterial filters, which is evidence that it is not ultra-microscopic).

"(7) The blood of a sheep which has recovered from the disease produced by inoculation does not continue to be infective by inoculation to others as in the case of piroplasmosis (redwater), and it is therefore unlikely that ticks can infect themselves from such animals. The same is true of material taken from a chronic case of louping-ill contracted by natural infection.

"(8) A sheep which has passed through a reaction following upon inoculation is protected to a very considerable extent against the effects of a subsequent inoculation, just as a sheep recovered from louping-ill in the field is highly resistant to further attacks. A small number of sheep

b. Chromatin bodies in nucleus. c. Larger chromatin bodies grouped in cell protoplasm. small chromatin bodies in cell protoplasm.
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which had been inoculated at the laboratory with blood survived exposure in the following season on louping-ill infected pasture, while four out of twelve (33·3 per cent.) other sheep not so inoculated, and exposed on the same pasture, died of typical louping-ill.

"(9) The blood of healthy sheep when inoculated in large amount to other sheep does not cause a reaction.

"(10) The disease which has been produced experimentally by larval ticks (*I. ricinus*) from females off sheep affected with louping-ill, and by adults which had fed as nymphs on infected sheep, and by the inoculation of gland juice and blood from such sheep, is, in fact, louping-ill. To conclude otherwise would involve the following further conclusions which are very difficult of acceptance :—

"(a) That the experimentally produced cases with conclusive symptoms and lesions . . . must be disregarded.

"(b) That there is a disease of sheep other than louping-ill, characterised by similar microscopic lesions and by similar varying symptoms, which is tick-borne and inoculable, and that sheep suffering from acute and typical louping-ill in the field are invariably attacked at the same time by this other disease, since inoculation of their gland juice or blood constantly produces it."

Inasmuch as the author considers the nature of louping-ill to have been thus established he proceeds to discuss the prospects of measures to cure, prevent, or eradicate the disease. Experiments in order to test the value of drug treatment, mostly with arsenical compounds, invariably proved unsuccessful. Work is in progress in order to determine the curative properties of an anti-serum, but no great hopes are entertained in this direction. Preventive inoculation with the blood of affected animals is said to have promising possibilities, and arrangements are being made to have it tested in practice. Investigations into the value of measures for the eradication of ticks are also contemplated either through the possibility of starving them out, allowing them to cleanse themselves by feeding on insusceptible animals, or by dipping of hosts.

MENIAUD (Jacques). **Les chevaux du Haut-Sénégal et Niger.** [The Horses of Upper Senegal and Niger.]—*La Vie Agric. et Rur.* 1918. Apr. 6. Vol. 8. No. 14. pp. 241–246.

In an article previously contributed to the above journal the author dealt with the resources of French Upper Senegal and Niger in horses (over 100,000), the origins of the various breeds, and the methods of horse breeding and feeding adopted by the natives. In this article the author continues his description of the equine population dealing particularly with the work the animals are put to, the commercial side of the problem, and the efforts of the French authorities and more enlightened individuals at improving the breeds. A fairly good appreciation of the diseases of horses in these territories is given.

From the point of view of general health the condition of the horses appears to diminish with decreasing altitude, with the exception that certain plateaux situated at some distance from the border of the Niger and other rivers afford quite good conditions for breeding. The horses survive but lose all their energy in regions with a humid atmosphere or with damp pastures soaked by long continued rains and floods, and in such districts slight degrees of injury or sickness are liable to terminate fatally. On the other hand, in the north, in the Sahel, South Sahara, and Azben country, the animals recover spontaneously from quite serious diseases on account of the atmospheric

dryness and bright sunlight. It was also to be noted that in the south the native population is less versed in the care of sick animals than the Moors and other tribes of the north.

Among the diseases which cause very serious losses particular mention must be made of tetanus, which is especially frequent in the regions of Zinder, Mopti, and the circles of Sikasso and Bobo-Dioulasso, where it is known to the natives as *diarani*.

The most serious drawbacks to horse breeding, however, are undoubtedly epizootic diseases,—lymphangitis, trypanosomiases, glanders, and a condition named by the author typho-malaria. The trypanosomiases are by far the most formidable of these diseases and horses in whole tracts of country are thereby decimated towards the end of the rainy seasons. The different species of Glossina known in French West Africa (*palpalis*, *tachinoides*, *longipalpis*) are not capable of harbouring the different trypanosomes to the same degree; for example, Bouet and Roubaud found that the causal organism of *baléri* was transmissible particularly by means of *longipalpis*, much less by *tachinoides*, and to hardly any extent by *palpalis*. According to Bouffard it is *G. palpalis* which predominates in Upper Senegal and Niger and the few *tachinoides* encountered are everywhere mixed with the *palpalis*; and thus unfortunately, he states, the tsetse fly capable of transmitting the most trypanosomiases is most prevalent in the Colony. Besides acting as the host of *T. gambiense*, the causal organism of sleeping sickness, it develops *T. cazalboui*, the organism of *souma*, *T. pecaudi*, the organism of *baléri*, and *T. dimorphon*, which is fairly rare in the Colony and is found more especially in Casamance, Guinea, and the Ivory Coast.

The tsetse flies do not appear to exist above the 14° N. parallel. Below this latitude the covered water courses with thickly wooded banks are nearly all inhabited by Glossina. The most important of these streams are the Niger, Bani, Bakoy, Bafing, and Falémé at their sources and their tributaries at their upper parts. *T. gambiense* has not been encountered throughout the whole of this fly district though it has been discovered in a few other places, but all the fly areas enumerated are stated to be foci of animal trypanosomiases affecting especially equines and certain bovines. *T. cazalboui* appears to be the pathogenic organism most commonly harboured by *G. palpalis* and *tachinoides* in the basins of the Niger, Bani, Volta Rivers, Upper Senegal and Falémé, but it is stated that Gambian horse sickness and dourine also exist in the Koury region; the symptoms of the last-named disease are often mistaken for those of *souma*. Various diseases with similar symptoms known to breeders on the borders of the Niger as *zanari* are also most probably one or other of the before mentioned trypanosomiases.

The author again brings forward evidence to show that tsetse flies are not the only vectors of animal trypanosomiases in Africa and other biting flies such as stomoxyds and tabanids are capable of acting as transmitters. The spread of trypanosomiases among a lot of healthy horses in districts situated at some distance from tsetse areas was seen to occur after the introduction of an animal that had contracted the disease in the tsetse areas. Moreover, *souma* causes great losses at some distance north of 14° N. lat.; the disease is being continuously imported into these healthy areas from the fly areas further south

and then transmitted locally by species of flies other than tsetse. The treatment adopted by the natives in cases of *souma* consists in providing the sick animal with good nourishment and tonics after preliminary adminstration of purgatives and diuretics.

REPORTS.

ASSAM. **Report of the Civil Veterinary Department for the Year 1917-1918.** 1918. 14 pp. f'cap. Shillong: Assam Secretariat Ptg. Office. [Price 8 annas or 8*d*.]

The substance of this report dealing mainly with statistics is well summarised in the Resolution appended by the Chief Secretary to the Chief Commissioner of Assam as follows:—

"The staff of the department was strengthened during the year by the addition of 4 new assistants and at the close of the year the staff available for local service consisted of 3 Inspectors and 36 Assistants. Five Veterinary Assistants were on deputation to military duty, and there are 20 stipendiaries in the Bengal Veterinary College.

"The number of deaths from contagious disease reported was 60,710, an increase of nearly 13,000 over the numbers of the preceding year and more than double those of 1913–14, since when the deaths reported have increased year by year. The increase is attributable largely to improved reporting, but there was a quite exceptional epidemic of rinderpest during the year in Goalpara. This single epidemic is said to have caused 14,294 deaths. Unfortunately in very few instances were reports of the outbreaks in that district received in time for preventive inoculation to be undertaken. The special attention of the veterinary and district officers is being drawn to this failure of the system of reporting. In the province as a whole there was a satisfactory increase in the number of inoculations against rinderpest, anthrax, and haemorrhagic septicaemia. The number rose from 36,016 to 45,704, and among the 38,295 animals inoculated for rinderpest, only 346 or 0·9 per cent. died.

"The number of villages visited and of animals treated by assistants on tour shows a decrease, of which no explanation has been furnished. The Chief Commissioner desires that in future explanations may be given of such important variations in figures.

"The question of the improvement of local breeds of cattle engaged the attention of the Chief Commissioner, and the Government of Bengal have been asked whether they will be able to supply this Administration with a few bulls for breeding purposes from the Rangpur Farm in Bengal.

"The Superintendent has drawn attention to the importance, when circumstances permit, of sending a number of Veterinary Assistants to the Veterinary College for a course of post-graduate training. The Chief Commissioner recognises that such a course of training is very desirable in the case of assistants who, owing to the isolation of their stations or for other reasons, are unable to keep their professional knowledge up to date. In order to give effect to the Superintendent's suggestion a definite scheme should be submitted by the Director of Land Records and Agriculture." . . .

BIHAR & ORISSA. **Annual Report of the Civil Veterinary Department for the Year 1917-18.** 1918. 8+xiv+2 pp. f'cap. With 1 chart. Patna: Supt. Govt. Ptg. [Price 8 annas or 8*d*.]

This report first deals with veterinary instruction. As in previous years condidates for the veterinary service were few and ill-qualified. According to the secretary to the Government the conditions in

respect of pay are not at present satisfactory, but proposals for their improvement have been submitted to the Government of India.

In horses the only ascertained cases of contagious disease were two of surra.

In bovines rinderpest, foot-and-mouth disease, and haemorrhagic septicaemia were very prevalent. The mortality from the last-named disease was very high (5,584 out of 7,018 affected). Outbreaks of blackwater and anthrax were also reported from some districts. Rinderpest was not so violent as in the preceding year but caused considerable mortality in Ranchi, Palamau, Gaya, Monghyr, and Cuttack. In the last district it is stated that the efforts of the Department were hampered by opposition based on local religious sentiments, which are not likely to disappear until education is more widely diffused The district of Shahabad which suffered severely in the previous year was practically free from the disease. The total number of outbreaks attended by veterinary assistants fell off considerably and this is attributed to bad communications, heavy rains, and absence of a considerable number of the staff. The apparent increase in the prevalence of foot-and-mouth disease is said to be largely due to more efficient reporting (77,895 animals affected, 1,041 died). Details are given regarding inoculations practised against rinderpest, haemorrhagic septicaemia, anthrax, and blackquarter. Inoculation fell off by about 10,000 cases.

CEYLON. **Administration Reports for 1917. Report of the Government Veterinary Surgeon** [STURGESS, G. W.]—6 pp. f'cap.

Infectious diseases.—Rinderpest occurred in six provinces and three remained free. The total number of cases for the year was 2,076, against 856 in the preceding year. The increase was chiefly due to a somewhat extensive outbreak in the town of Colombo—806 cases. There was a great increase in the number of cases of foot-and-mouth disease during the year and all provinces were affected. The total number of cases was 7,132 against 284 in the preceding year. The disease was of a very mild type only 94 deaths being reported. The number of cases of anthrax outside Colombo was 62. In the town six cases occurred, and in the quarantine station 472 cases among goats and sheep imported from South India, the disease being very prevalent among these animals during shipment. Rabies was more prevalent than usual during the year, especially in Colombo town. Forty two cases were examined at the bacteriological institute, of which 25 gave positive and 17 negative results. A few cases of infection by *P. bigeminum* were reported from time to time, especially amongst imported European cattle. No cases of surra were reported. In June two cattle died in Uva of eating rubber leaves, a ball of leaves and coagulated rubber being found in the throat on post-mortem examination. There were no further cases of swine septicaemia reported.

There was no outbreak of infectious disease among horses during the year. The disease which caused most loss amongst these animals was osteoporosis. A considerable amount of work is stated to have been done in the laboratory upon this disease during the year. The

investigations were directed to ascertaining whether the small micrococcus, reported by CAROUGEAU, in Madagascar, or whether the nematode worms (*Cylicostomum tetracanthum*) found in the caecum and colon as stated by CONREUR in Brazil, had any relationship with the disease. The results were all negative.

The incidence of the above diseases in the various provinces is then tabulated. The total number of cattle and buffaloes in the Island was 1,620,768. Two hundred and thirty cattle exposed to rinderpest infection were inoculated with anti-serum; 188 remained free, 42 became ill within a month, and of these 17 recovered and 25 died. A number of statistical returns dealing with the importation of livestock, quarantine measures, rabies, and the Government Dairy and Model Farm are then given.

GOLD COAST. **Report on the Veterinary Department for the Year 1917.** [McDOUALL, J. C., Acting Veterinary Officer.] 1918. 5 pp. f'cap. Accra: Goverment Press.

All cattle arriving at Coomassie were inspected and of these 26 were detained as they showed suspicious symptoms of contagious disease. Four of these animals died during detention and 22 were slaughtered. All are said to have exhibited definite post-mortem lesions of rinderpest. This disease is said to be still active in the Northern Territories and French country and spread by owners taking infected cattle where they may be safe from inspection by a Government official, thus infecting new areas. Statistics are given with regard to the exportation and importation of live stock from Coomassie during the year. Scabies appears to have been very prevalent in dogs, sheep, and goats in Commassie town. The herd at the Livestock Farm, Coomassie was in a healthy state.

MADRAS PRESIDENCY. **Annual Administration Report of the Civil Veterinary Department for 1916-1917.** 1917. 22 pp. f'cap. With 1 map. Madras: Superintendent Govt. Press. [Price 8 annas or 9*d.*]

This report comprises the Annual Report of the Superintendent Civil Veterinary Department, Madras, and the Annual Report of the Madras Veterinary College. The bulk of the report deals with statistics.

There was an increase in the number of contagious diseases under every head as compared with the previous year (68,588 against 57,472). No glanders or dourine was reported, 16 cases of surra were diagnosed, 8 cases of piroplasmosis in cattle and one in the horse were confirmed, 58 cases of the equine disease known as kumri were diagnosed at the different hospitals. 26,215 deaths from rinderpest were reported as against 22,268 in the previous year. The Guntúr district suffered most. The double inoculations performed against this disease numbered 100,463 against 90,898 in the previous year. 7,900 deaths from anthrax and 8,635 from haemorrhagic septicaemia were reported. Blackquarter caused 6,927 deaths and foot-and-mouth disease 2,637 deaths. It is stated that the skinning of carcases of animals dead of contagious diseases and the throwing of carcases into the rivers by natives are important factors in the spread of contagion.

MAURITIUS. **Annual Report on the Department of Agriculture for 1917. Annexure 3. Report on the Work of the Veterinary Division.** [LIONNET, F. E., Veterinary Surgeon.] pp. 12–13 f'cap.

During the year surra was detected in mules on a number of estates. Animals on these estates were placed in quarantine and soamin and arsenic treatment employed. The results obtained are stated to have been successful; the experiments were apparently controlled. Two mules treated by Laveran's method relapsed five times and finally recovered after eight months. Several outbreaks of foot-and-mouth disease occurred during the year. Two fatal cases of piroplasmosis were reported in milch cows. Epizootic lymphangitis was detected in a sandalwood pony. A contagious disease of undetermined nature occurred among sheep. Two cases of tuberculosis were detected in the abattoir. The importance and necessity of dipping tanks is getting more known and appreciated in the Colony; many estates have already constructed tanks and have obtained satisfactory results. It is held that this will prove a great step forward towards improvement in breeding cattle, especially in districts where ticks are abundant.

MUKTESAR LABORATORIES. **Annual Report of the Director and First Bacteriologist** [SHEATHER, A. Leslie] **for the Year ending 31st March 1918.**—MS. 18 pp. f'cap. With 2 tables.

A brief account is first given with regard to the administration of the establishment including arrangements made for fodder and grain supply, forests, and water supply, electric centrifuges, supply of hill bulls and plains animals, the Bareilly branch laboratory, and tours of investigation undertaken. The Second Bacteriologist (SHILSTON, A. A.) was employed in Mesopotamia from the months of June to October. To meet the increasing demands for anti-rinderpest serum it was found necessary to open the branch laboratory at Bareilly during the winter months, and maintain between 150 and 200 serum animals there. The work of the laboratory was seriously interfered with on account of two outbreaks of relapsing fever among the coolies and gwallas.

Preparation of serums and vaccines.—A considerably increased quantity of anti-rinderpest serum, now amounting to over 2,000,000 doses, was manufactured and issued as compared with the preceding year. There was a decreased demand for anthrax serum and hence a smaller quantity was manufactured. An increased quantity of haemorrhagic septicaemia serum (216,457 doses prepared, 189,428 doses issued) was prepared. The quantity of vaccine prepared against this disease showed a slight decrease. No necessity arose for manufacturing an additional quantity of blackquarter vaccine as the demands (17,324 doses) were complied with from stock in hand. The demand for mallein was very excessive (193,147 doses issued as against 35,972 in the preceding year). An increased quantity of tuberculin was also manufactured. Strangles serum and vaccine and miscellaneous vaccines were prepared as in previous years. The following Table shows the main results obtained by the use of these vaccines.

A number of interesting specimens were examined at the laboratory. Owing to the deputation of the Second Bacteriologist to Mesopotamia

MUKTESAR LABORATORIES.] TABLE.

	Number of outbreaks in which inoculation was undertaken	Number of animals which died uninoculated in course of disease.			Number of animals inoculated.			Number of animals which died after inoculation.			Percentage of deaths in inoculated bovines
		Equines.	Bovines.	Others.	Equines.	Bovines.	Others.	Equines.	Bovines.	Others.	
Anti-rinderpest serum	3,972	—	67,491	95	—	495,117	709	—	1,936	4	0·39
Anthrax serum ..	106	25	1,457	4	571	9,911	184	—	29	—	0·29
Haemorrhagic septicaemia serum	1,094	1	8,918	77	20	130,322	794	1	133	—	0·10
Haemorrhagic septicaemia vaccine	235	—	296	—	—	50,406	—	—	9	—	0·01
Blackquarter vaccine	95	—	166			9,435	—	—	40	—	0·42

work in connection with the serum test in the diagnosis of dourine was greatly interrupted. By this test 11 cases proved to be positive, 11 doubtful, and 201 negative. Details are added concerning inoculations at the Military Dairy, which included imported Ayrshire bulls inoculated against piroplasmosis and rinderpest. Unfortunately foot-and-mouth disease broke out while these inoculations were in progress with the result that some animals suffered severely from both this disease and rinderpest.

Research.—Shortness of staff and increase in routine and administrative duties seriously limited the time that could be given to research work. The question of the vitality of the virus of rinderpest under varying conditions is still under investigation and a special series of experiments is being carried out with the object of ascertaining the length of time during which hides removed from animals dead of rinderpest remain infective. The modifications in the manufacture of anthrax and haemorrhagic septicaemia sera, foreshadowed in last year's report [see this *Bulletin*, Vol, 5, No. 1, p. 67], have been effected and resulted in a very distinct reduction in the mortality among the serum making animals and also in a saving of labour. The question as to the length of time hides of animals dead of haemorrhagic septicaemia remain infective is also under investigation.

A number of attempts were made to isolate the organism responsible for abortion of cattle but all failed owing to the presence of numerous contaminating organisms in the materials sent to the laboratory. A strain of the organism was obtained from England and a number of tests are now being carried out with regard to the disease but the number is stated to be too small to warrant any definite opinion; the results, however, appear to indicate that the same bacillus is responsible for the disease in India. In last year's report a reference was made to the occurrence of Johne's disease among cattle in India. Two cattle kept under observation were proved on post-mortem examination to have been undoubtedly affected with this disease. Buffaloes placed in contact with the above animals have hitherto shown no sign of having become infected. The disease was also diagnosed in the viscera of two animals obtained from Poona.

A number of strains of tubercle bacilli from bovine lesions have been isolated and these are being studied.

Pleuro-pneumonia of goats was also the subject of experimental work and a quantity of material from a natural case of the disease was received. Unfortunately pneumonia of a different type broke out among the animals selected for experiment and it was found impossible to use the material available with any hope of getting reliable results.

In the tables appended data are given with regard to the doses of the various products issued and the main results of the working of the laboratory.

NIGERIA. **Annual Report on the Agricultural Department, Northern Provinces, for the Year 1916. Appendix I. Revision of Veterinary Report for the Year 1916.** [BRANDT, F. R., Chief Veterinary Officer.]—pp. 7–10 f'cap.

In July 1916 a number of rules were drawn up for adoption by the native administration to control the spread of contagious disease.

There appears to be no doubt that rinderpest has been enzootic in Nigeria for years. Twenty one outbreaks were reported in which the mortality amounted to 40 per cent. The methods of dealing with outbreaks have been those of segregation and isolation of diseased animals. The disease was nearly always too far advanced when first reported to warrant inoculation with anti-rinderpest serum. Pleuro-pneumonia is widespread throughout the country. Forty-one outbreaks were reported and no doubt many others occurred. The measures of isolation of sick and segregation of infected herds were adopted. Slaughter of all diseased animals and compensation to owners has been strongly advised. The setting aside of large areas in each province solely for the use of pleuro-pneumonia herds had been advocated and endeavours are now being made to select such areas. The natives of West and East Africa have for years practised a method of inoculation in which a piece of diseased lung is inserted beneath the skin of the face of a susceptible animal. Native preparation of the virulent material varies, in some parts the liquid virus is used mixed with milk, in others the diseased lung is buried until putrefaction takes place and in others it is mixed with ashes. The local effects of inoculation with such material are severe and many deaths result, but nevertheless the method appears to have a marked effect in curtailing an outbreak and conferring immunity on many of the animals.

Trypanosomiasis appears to be very prevalent in the southern part of the Northern Provinces, and the trypanosomes vary considerably in virulence. Measures are being adopted for preventing movement of cattle by nomad tribes.

RANGOON MUNICIPALITY. **Report on the Working of the Veterinary Department for the Year 1917-18.** [BLAKE, A., Veterinary Officer.]—1918. 7 pp. f'cap. Rangoon: British Burma Press.

Since the year 1910 a serious effort has been made to eradicate glanders which had become very prevalent amongst the horses of Rangoon. During that year 506 animals were destroyed and 296 were definitely ascertained post-portem to have been affected with the disease. In the year under report the number had decreased to two clinical cases and four reactors to mallein. One case of epizootic lymphangitis was detected. There were no cases of surra. Anthrax affected 5 horses, 15 cattle, and 1 goat. The Municipality suffered in the year under report the worst visitation of rinderpest during the last 25 years. Eight cases of rabies were diagnosed. Statistics are given regarding the abattoirs, cattle market, and other duties under the supervision of the veterinary officer.

UNITED PROVINCES, INDIA. **Annual Report on the Civil Veterinary Department for the Year ending 31st March 1918.**—pp. 22 f'cap. Allahabad: Supt. Govt. Press. 1918. [Price 8 annas or 9*d.*]

During the year under review the reported mortality from various contagious diseases was 17,407. The increase over the preceeding year was chiefly due to the extension of the prevalence of surra and to severe outbreaks of foot-and-mouth disease, haemorrhagic septicaemia, blackquarter, and anthrax.

Equines.—Forty two cases of glanders and farcy were detected during the year in nine districts. It assumed a severe form in the dak line between Dehra Dun and Rajpur. As usual surra made its appearance in the tracks along the foot of the hills but outbreaks in a severe form occurred in the districts of Etawah, Mainpuri, Banda and Naini Tal. In the districts of Mainpuri and Banda increased numbers of the staff were delegated to deal with the outbreak and it is said that if action had not been taken to deal with the disease in time it would have caused disastrous results. Six hundred cases are known to have either succumbed or were destroyed, but there is every reason to believe that many cases occurred in outlying localities. A number of cases of tetanus, strangles, horse pox, piroplasmosis, influenza, anthrax, rabies, and diseases caused by internal and external parasites were also met with.

Bovines.—During the year under report there was a slight abatement in the ravages caused by rinderpest and many localities escaped lightly. It assumed a severe form in four districts. Inoculations were carried out in 34 districts and altogether 26,224 animals were immunised. Haemorrhagic septicaemia appeared in a specially virulent form and attacked 41 districts, resulting in a total mortality of 3,142. 21,491 head of cattle were inoculated with very satisfactory results, and it is believed that had it not been for these measures very much more severe losses would have occurred. The Provinces again suffered very severely from foot-and-mouth disease; it prevailed with greater or less intensity throughout the whole area, very few districts escaping its ravages. The reported losses from the disease were 2,854, the mortality being chiefly confined to young stock and old and weak decrepit animals. The disease, moreover, caused great inconvenience to agriculturists especially during the harvest and ploughing seasons. Cattle fairs and markets are responsible for much of its spread. The question how to deal effectively with this disease is a very serious one in a country like India owing to the large tracts of unfenced land where the cattle can wander at will and spread infection among animals with which they come in contact. Blackquarter appeared in 20 districts and caused 3,114 deaths. Vaccination was adopted as a preventive measure in some places. Anthrax occurred in 30 districts, producing a mortality of 1,687. 145 head of cattle were reported as having died from other contagious diseases, including pleuro-pneumonia, tuberculosis, contagious abortion, etc.

Amongst other animals pleuro-pneumonia and rinderpest were as usual responsible for many deaths among sheep and goats. Rabies, canine distemper, tetanus, haemorrhagic septicaemia, fowl cholera, spirochaetosis, surra, and various parasitic ailments accounted for many deaths among the smaller domesticated animals.

There was a decrease in the number of animals inoculated. Many interesting specimens of blood, morbid tissues, and other intestinal parasites were submitted to the headquarters laboratory by the subordinate staff and also by district authorities for pathological and bacteriological examination. Investigations were conducted in connection with kumri, gillar, bursati, akrah, fowl cholera, piroplasmosis, etc. The prophylactic and curative effects of distemper, tetanus, and strangles vaccine were tested. [It would be interesting

to examine the published results of these important investigations —Ed.] The research and experimental station at Badshahbagh is said to fulfil a useful purpose in affording a great opportunity to the subordinate staff for the observation and study of disease and methods of research. At the request of the Director and Imperial Bacteriologist an enquiry is being made into the prevalence of Johne's Disease.

Details are next given with regard to veterinary hospitals and dispensaries, subordinate establishment, veterinary instruction, and the somewhat extensive breeding operations carried on under the supervision of the Department. According to the Superintendent it is satisfactory to be able to report that in nearly every branch of the work of the Civil Veterinary Department very satisfactory progress is still being made.

Zanzibar Protectorate. **Annual Report Public Health Department for 1916. Veterinary Division Report for 1916.** [Aders (W. M.).] pp. 26–31. 1917. Zanzibar.

In this report the author deals with outbreaks of trypanosomiases and East Coast Fever that had occurred among animals during the year. In a number of cases cattle in apparent good health were found to harbour trypanosomes of the *T. pecorum* type in their blood. This trypanosome is the cause of bovine trypanosomiases in Zanzibar. It is believed that this organism is transmitted by means of Tabanidae and not by Stomoxys. No tsetse fly exist in the Island. The author hopes to collect statistics dealing with the incidence and distribution of the disease in the more remote districts where gadflies are common.

Rousseau (L.). **Ma'adies parasitaires à Douala (Cameroun).** [Parasitic Diseases at Duala, Cameroons.]—*Bull. Soc. Path. Exot.* 1918. Oct. Vol. 11. No. 8. pp. 744–759.

Animal trypanosomiases.—Ten years ago there existed two primitive humpless breeds of cattle in the district around Duala, but they have now become completely extinct as the result of a severe epizootic and also on account of the wholesale slaughter carried out at the instigation of the Germans. A number of cattle brought into the town of Duala for slaughter succumbed to a disease which on examination of the blood proved to a be trypanosomiasis. Some of the animals were attacked during the course of the journey and succumbed in from 5 or 6 to 48 hours after the first symptoms. Shortly before death they showed considerable wasting, dullness, rough coat, swelling of the extremities, slight diarrhoea, and often marked anaemia. The trypanosome showed active wriggling movements and was somewhat difficult to find in the peripheral blood. Inoculation of guinea-pigs gave negative results.

A case of trypanosomiasis was diagnosed in a horse showing symptoms of weakness and paraplegia. Microfilariae were also observed in the blood of this animal. During certain periods trypanosomiasis is said to cause heavy mortality among dogs. Tsetse flies are somewhat rare in the town and on the adjacent plateau. *G. palpalis* is of widespread distribution while *G. pallicera* and *G. fusca* were identified in certain districts.

BRITISH MUSEUM 20 JAN 19

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 6, No. 2, pp. 129-140.]

PROTOZOAN PARASITES.

BÉKENSKY (P.). Sur les Spirochétes du tube digestif des Rongeurs [The Spirochaetes of the Intestinal Tract of Rodents.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. June 20. *Rec. Méd. Vét.*, 1918. June 30. Vol. 94. No. 12. pp. 296–298.

BRUG (S. L.). The Genus *Endoplasma* Castellani, 1914.—*Jl. Trop. Med. & Hyg.*, 1918. June 1. Vol. 21. No. 11. pp. 114–115. With 1 plate.

DE CAMPOS (Jose Mariano) & DE SÁ (Carlos Accioly). Diagnostico e tratamento da tristeza. [Diagnosis and Treatment of Bovine Redwater.]—*Rev. Vet. e Zootechnia*, 1918. Vol. 9. No. 1. pp. 16–28.

COMMES (Ch.). *Haemoproteus* d'Oiseaux du Haut-Sénégal et Niger. [Haemoproteus of Birds in Upper Senegal and Niger.]—*Bull. Soc. Path. Exot.*, 1918. June. Vol. 11. No. 6. pp. 443–445.

CHATTON (Edouard). La nutrition des flagellés intestinaux du genre *Trichomastix*, en cultures pures. Simplifications rationelles de la méthode de culture: Les tissus coagulés. [Nutrition of Intestinal Flagellates of the Genus Trichomastix. The Use of Coagulated Tissues as a Rational Simplification in Cultural Methods.]—*C.R. Soc. Biol.*, 1918. July 20. Vol. 81. No. 14. pp. 774–777.

—— & BLANC (Georges). Culture du trypanosome du gecko chez la punaise des lits. [Cultivation of the Trypanosome of the Gecko in the Bed Bug.]—*Bull. Soc. Path. Exot.*, 1918. May. Vol. 11. No. 5. pp. 387–391.

—— & ——, Le *Leptomonas* de la Tarente dans une région indemne de Bouton d'Orient. Observations et expériences. [Leptomonas in the Gecko (*Tarentola mauritanica*) in a Region Free from Oriental Boil.]—*Bull. Soc. Path. Exot.*, 1918. July. Vol. 11. No. 7. pp. 595–609.

CROWELL (B. C.) & HAUGHWOUT (F. G.). Observations on the Incidence of Intestinal Spirochetes in the Philippine Islands.—*Jl. Infect. Dis.*, 1918. Mar. Vol. 22. No. 3. pp. 189–193. With 1 chart.

GALLI-VALERIO (B.). Coccidia in the Intestines—Red Dysentery of Cattle—Observations on Eimeria Zurni-Rivolta.—Abstracted in *Vet. Jl.*, 1918. June. Vol. 74. No. 6. pp. 219–223.

LAVERAN (A.). Boutons d'Orient expérimentaux chez un Chimpanzé. [Oriental Boil Experimentally Produced in a Chimpanzee.]—*Bull. Soc. Path. Exot.*, 1918. July. Vol. 11. No. 7. pp. 561–562.

LÉGER (Marcel). Infection sanguine par *Leptomonas* chez un Saurien. [Blood Infection by Leptomonas in a Lizard.]—*C.R. Soc. Biol.*, 1918. July 20. Vol. 81. No. 14. pp. 772–774.

RAILLIET (A.). La coccidiose du lapin. [Coccidiosis of the Rabbit.]—*Bull. Acad. Agric.*, Paris, 1917. Nov. 7. Extracted in *Rec. Méd. Vét.*, 1918. Aug. 15–Sept. 15. Vol. 94. Nos. 15 & 17. pp. 452–453.

SANGIORGI (Giuseppe). Coccidiosi renale ed intestinale nell' uomo da *Isospora bigemina*. [Renal and Intestinal Coccidiosis in Man due to *I. b.*]—*Pathologica*, 1918. Apr. 1. Vol. 10. No. 225. pp.73–75. With 2 figs.

SERGENT (Et.). Une Hémogrégarine de *Vipera libetina* L. d'Algérie. Début de l'evolution de cette Hémogrégarine chez un Acarien. [A Haemogregarine of *V. l.* of Algeria. Commencement of its Development in an Acarid.]—*Bull. Soc. Path. Exot.*, 1918. Apr. Vol. 11. No. 4. pp. 278–281. With 25 figs

SERGENT (Edm. & Et.), FOLEY (H.), & LHÉRITIER (A.). De la mortalité dans le Debab, Trypanosomiase des Dromadaires. [Mortality in *Debab*, a Trypanosomiasis of Dromedaries.]—*Bull. Soc. Path. Exot.*, 1918. July. Vol. 11. No. 7. pp. 568–570.

"I. In two carefully observed cases of naturally contracted *debab* in the dromedary, the disease proved fatal in four months. One dromedary inoculated experimentally with infected blood appeared to have recovered in 18 months.

"II. *Debab* lowers the resistance of infected dromedaries and makes them more susceptible to the effects of other infections, poor feeding and overwork. In this respect it resembles human malaria."

SCHULTZ (C. H.). Mysterious Losses among Cattle in the Pacific Northwest. A Clinical Study.—*Jl. American Vet. Med. Assoc.*, 1918. Sept. Vol. 53. (New Series, Vol. 6.) No. 6. pp. 711–732.

The author describes the clinical manifestations in outbreaks of coccidiosis among cattle.

VELU (H.). Les troubles oculaires et locomoteurs dans la trypanosomiase des chevaux du Maroc. [Ocular and Locomotory Disturbances in Equine Trypanosomiasis in Morocco.]—*Bull. Soc. Path. Exot.*, 1918. July. Vol. 11. No. 7. pp. 566–568.

For a summary of the contents of the above paper see an extract of another paper by this author on p. 218 of this *Number*.

METAZOAN PARASITES.

Arthropods (Acari, Flies, Ticks).

ADERS (W. M.) Economic Biology . Entomology in Relation to Public Health and Preventive Medicine and Veterinary Science.—*Zanzibar Protectorate Ann. Rept. Pub. Health Dept. for* 1916. pp. 32–37. 1917. Zanzibar: Govt. Printer.

BEQUAERT (J.). Parasitic Muscid Larvae collected from the African Elephant and the White Rhinoceros by the Congo Expedition.—*Bull. American Mus. Nat. Hist.*, 1916. Vol. 35. pp. 377–387.

BISHOPP (F. C.) & WOOD (H. P.). Preliminary Experiments with Sodium Fluoride and Other Insecticides against Biting and Sucking Lice.—*Psyche*, Boston, Mass., 1917. Dec. Vol. 24. No. 6. pp. 187–189.

CAMERON (A. E.). Some Blood-Sucking Flies of Saskatchewan.—*Jl., American Vet. Med. Assoc.*, 1918. Aug. Vol. 53. (New Series, Vol. 6). No. 5. pp. 632–638.

CARTER (Henry P.). Simple Treatment of Manure to Prevent Fly Breeding —The Panama Method.—*Proc. Med. Assoc. Isthmian Canal Zone*, 1917. Jan.–June. Vol. 10. Part 1. pp. 79–80. With 5 plates.

Carpenter (G. H.) & Pollard (F. J. S.). The Presence of Lateral Spiracles in the Larva of *Hypoderma*.—*Proc. Roy. Irish Acad.*, 1918. Apr. Vol. 34. Sect. B. No. 4. pp. 73–84. With 22 figs.

Chacaras e Quinthes (San Paulo), 1918. Jan. 15. Vol. 17. No. 1. pp. 13–15. Contra os Piolhos do Porco. [Against Pig Lice.]

Du Toit (P. J.). Uber Zecken und deren Bekämpfung. [Ticks and their Control.]—*Ztschr. f. Infektionskr. d. . . . . Haustiere*, concluded 1918. Feb. & June. Vol. 19. Nos. 2 & 3. pp. 97–128. 210–241.

Ewing (H. E.) & Hartzell (Albert). The Chigger-Mites affecting Man and Domestic Animals.—*Jl. Econ. Entom.*, 1918. Apr. Vol. 11. No. 2. pp. 256–264. With 1 text-fig.

Fitch (C. P.). Animal Parasites affecting Equines.—*Jl. American Vet. Med. Assoc.*, 1918. June. Vol. 53. (New Series, Vol. 6.) No. 3. pp. 312–330.

Hall (Maurice C.). The Control of Lice on Horses, with Especial Reference to Winter Conditions.—*Vet. Jl.*, 1918. Aug. Vol. 74. No. 8. pp. 278–284.

Hollister (W. L.). Parasites of Swine.—*Jl. American Vet. Med. Assoc.*, 1918. June. Vol. 53. (New Series, Vol. 6.) No. 3. pp. 330–334.

Jepson (F. P.). Insects injurious to Man and Animals.—*Dept. Agric. Fiji, Report for the Year* 1916–1917. Nov. 20. pp. 23–25. Suva.

Knowles (A. D.). Parasites of Sheep.—*Jl. American Vet. Med. Assoc.*, 1918. June. Vol. 53. (New Series, Vol. 6.) No. 3. pp. 334–344.

Mote (D. C.) Some External Parasites of Poultry.—*Ohio Agric. Exper. Stat.*, Bulletin No. 320. 1917. Dec. pp. 139–156. With 14 figs.

Newstead (R.). Polypneustic Lobes in the Larvae of Tsetse-flies (*Glossina*) and Forest-flies (*Hippoboscidae*).—*Ann. Trop. Med. & Parasit.*, 1918. July. Vol. 12. No. 1. pp. 93-107. With 7 text-figs.

Place (F. E.). Sheep Nasal Fly.—*Jl. Dept. Agric. South Australia*, 1917. Dec. Vol. 21. No. 5. pp. 443–444.

Reidy (J. B.). Cattle Tick Eradication.—*Texas Dept. Agric.*, Proc. 7th Meeting Texas State Farmers' Institute, 1917. Nov.-Dec. Bull. No. 57. pp. 17–23. With 1 map.

Smith (Ernest J.). Organising and Conducting State-Wide Tick Eradication in Louisiana.—*Jl. American Vet. Med. Assoc.*, 1918. Aug. Vol. 53. (New Series, Vol. 6.) No. 5. pp. 639–645. With 7 text figs.

Taylor (F. H.). Australian Tabinadae, [Diptera] No. 2.—*Proc. Linnean Soc., N.S.W.*, Sydney, 1917. Apr. 4. Vol. 41. No. 164. pp. 746-762.

Tetley (H.). The Structure of the Mouth-parts of *Pangonia longirostris* in Relation to the probable Feeding-Habits of the Species.—*Bull. Entom. Res.*, 1918. Feb. Vol. 8. Nos. 3–4. pp. 253–267. With 11 text figs.

Wilhelmi (J.). Die gemeine Stechfliege (Wadenstecher); Untersuchungen ueber die Biologie der *Stomoxys calcitrans*, L. [The Common Biting-Fly; Investigations on the Biology of *Stomoxys calcitrans*.] —110 pp. With 28 figs. Berlin: Paul Parey. [Price, Mark 6.50.]

Helminths.

Frenkel (H. S.). Distomatosis der mesenterialen Lymphdrüsen des Rindes. [Fluke Invasion of the Mesenteric Lymphatics in the Ox.]—*Ztschr. f. Infektionskr. . . . . d. Haustiere.*, 1918. Sept. Vol. 19. No. 4. pp. 384–387. With 1 text fig.

Hall (Maurice C.) & Wigdor (Meyer). Notes on the Acanthocephalid and Arthropod Parasites of the Dog in North America.—*Jl. American Vet. Med. Assoc.*, 1918. July. Vol. 53. (New Series, Vol. 6.) No. 4. pp. 493–500.

—— & ——. Two New Flukes from the Dog.—*Jl. American Vet. Med. Assoc.*, 1918. Aug. Vol. 53. (New Series, Vol. 6.) No. 5. pp. 616–626. With 6 text figs.—*Alaria americana* and *A. michiganensis.*

—— & ——. A Physaloptera from the Dog, with a Note on the Nematode Parasites of the Dog in North America.—*Jl. American Vet. Med. Assoc.*, 1918. Sept. Vol. 53. (New Series, Vol. 6). No. 6. pp. 733–744. With 6 text figs.

Hilgermann & Weissenberg (Richard). Nematodenzüchtung auf Agarplatten. [Cultivation of Nematodes on Agar Plates.]—*Cent. f. Bakt.* 1. Abt. Orig., 1918. Feb. 28. Vol. 80. No. 7. pp. 467–472.

Leger (Marcel). Microfilaires animales en Guyane Française. [Animal Microfilariae in French Guiana.]—*Bull. Soc. Path. Exot.*, 1918. May. Vol. 11. No. 5. pp. 392–395.

Leiper (R. T.). Is the Cat really a Definitive Host of *Dicrocoelium lanceatum?* A Note on some Flukes from British Guiana and the Malay States.—*Vet. Jl.*, 1918. Sept. Vol. 74. No. 9. pp. 327.

"On present knowledge I prefer to accept the view that (*a*) the sheep fluke does not use the cat as an alternative definitive host; (*b*) the flukes found by Mr. Bodkin [in British Guiana] and by Dr. Wellington [in the Malay States in the Cat], probably belong to a distinct species of an allied genus, viz., *Platynosomum*, and (*c*) the early record by v. Siebold, etc., of the occurrence of *Dicrocoelium lanceatum* in the cat remains still an isolated, doubtful, and unconfirmed statement."

Mouchet (R.). Sur des lésions anatomiques produites par des Nématodes. [Anatomical Lesions Produced by Nematodes.]—*Bull. Soc. Path. Exot.*, 1918. July. Vol. 11. No. 7. pp. 573–575. With 1 plate comprising 2 figs.

a. Cysts of the intestinal wall in a leopard, caught near Lake Tanganyika, set up by *Galoncus perniciosus* Linstow, 1885. *b*. Adenomatous-like growths in the gall bladder of two rodents (*Thryonomys swinderianus* Temmink, 1827), caused by *Acheilostoma moucheti* Raill., 1918.

Seurat (L. G.). Extension de l'habitat du *Spirura gastrophila* (Mueller).—*C.R. Soc. Biol.*, 1918. July 27. Vol. 81. No. 15. pp. 789–791.

Sparapani (Giuseppe Carlo). Sulla comparsa di emolisine specifiche nel siero di sangue di animali trattati con carni verminose. [Reactions of Specific Emulsion towards Blood Serum of Animals treated with Verminous Flesh.]—*Pathologica*, 1918. May 1. Vol. 10. No. 227. pp. 93–95.

TRAVASSOS (Lauro). Helmintes parasitos de animaes domesticos. [Helminths Parasitic in the Domesticated Animals.]—*Rev. Vet. e Zootechnia*, 1918. Vol. 9. No. 1. pp. 3–15. With 6 text figs.

YORKE (Warrington) & MACFIE (J. W. S.). Strongylidae in Horses. iv *Gyalocephalus capitatus, Loos.* v *G. equi, sp. n.*—*Ann. Trop. Med. & Parasit.*, 1918. July. Vol. 12. No. 1. pp. 79–92. With 12 text figs.

MYCOTIC DISEASES.

CAPMAU. Quelques observations sur la lymphangite épizootique. Méthode Velu et méthode Belin. [Some Observations on the Treatment of Epizootic Lymphangitis by Velu's and Belin's Methods.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. June 20. *Rec. Méd. Vét.*, 1918. Aug. 30. Sept. 30. Vol. 94. Nos. 16 & 18. pp. 337–360.

MORI (Nello). Coltivazione del germe specifico de Farcino criptococcico. —Riproduzione sperimentale della malattia naturale nel cavallo. —Primi risultati di cura con un particolare prodotto specifico. [Cultivation of the Specific Organism of Epizootic Lymphangitis. Experimental Reproduction of the Natural Disease in the Horse. Preliminary Results in Treatment with a Particular Specific Product.]—*Clinica Vet.*, 1918. June 15–30. Vol. 41. Nos. 11–12. pp. 320–329.

VELU (H.). Quelques observations relatives à l'étiologie de la Lymphangite épizootique. [A few Observations regarding the Etiology of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.*, 1918. May. Vol. 11. No. 5. pp. 351–357.

——. Les Variations leucocytaires dans le traitement de la Lymphangite Epizootique par la Pyothérapie polyvalente. [Variations in Numbers of Leucocytes in the course of Treatment of E.L. by means of Polyvalent Pyotherapy.]—*Ibid.* pp. 416–423. With 2 charts.

DISEASES DUE TO FILTERABLE VIRUSES.

ANDREIN (Alejamdro) & BADANO (Carlos H.). La peste aviare (Pestis avium) nella Repubblica Argentina. [Fowl Plague in the Argentine Republic.]—*Nuovo Ercolani*, 1918. June 30. Vol. 23. No. 12. p. 158. (extract).

BERRY (A. Holman). Some Remarks on Foot and Mouth Disease and other Diseases in relation to Differential Diagnosis.—*Vet. Record*, 1918. June 8. Vol. 30. No. 1,561. pp. 497–504.

The author deals concisely with the clinical manifestations in the following conditions.—(1) Catarrhal stomatitis, (2) petechial stomatitis, (3) papular stomatitis, (4) foot-and-mouth disease, (5) vesicular stomatitis, (6) pustular stomatitis, (7) ulcerative stomatitis, (8) necrosing stomatitis, (9) necrotic ulcers on tongue, (10) mycotic stomatitis or "dirty tongue" disease, (11) pseudo-membranous stomatitis of sucklings, (12) spreading sores of lips, (13) Ranula or Frog tongue, (14) actinomycotic stomatitis, (15) pustular dermatitis.

CARPANO (Matteo). Su di un virus filtrabile di probabile origine bovina. [A Filterable Virus Probably of Bovine Origin.]—*Clinica Vet.*, 1918. July 15. Vol. 41. No. 13. pp. 347–357.

FEERS (A. G.). Infectious Anemia of Horses.—*American Jl. Vet. Med.*, 1918. Nov. Vol. 13. No. 11. pp. 527–533. With 10 text figs.

The author describes the clinical manifestations and some attempts at treatment of the disease in U.S.A.

GUARNIERI (Giuseppe). Studi sul vaiuolo. [Studies on Variola.]—*Sperimentale*, 1918. Jan. 17. Vol. 72. No. 1–2. pp. 1–36. With 3 plates.

HEIZMANN. Vier Fälle von paralytischer Lumbago als Begleitsymptom von infektiöser Anämie der Pferde. [Four Cases of Paralytic Lumbago as an Accompanying Symptom in Equine Infectious Anaemia.]—*Berliner Tier. Woch.*, 1918. July 11. Vol. 34. No. 28. pp. 274–276.

LANFRANCHI (A.) & LENZI (F.). Sul pasaggio del virus rabido dalla madre al feto.—[Passage of Rabies Virus from Mother to Foetus.]—*Ann. d'Igiene*, 1918. May 31. Vol. 28. No. 5. pp. 233–237.

The substance of this article was extracted from another journal in the preceding number of this *Bulletin*, p. 185.

MCARTHUR (Clifford L.). The Attenuation of Hog Cholera Virus and its Effect on Normal Hogs.—*Jl. Infect. Dis.*, 1918. June. Vol. 22. No. 6. pp. 541–558. With 3 text figs.

MARTIN (G.). Note sur la récolte du vaccin ensemencé sur génisse et sur les résultats obtenus avec le vaccin sec au Cameroun. [Method of Obtaining Vaccine from Inoculated Heifers and Results Obtained after Use of Dried Vaccine in the Cameroons].—*Bull. Soc. Path. Exot.*, 1918. July. Vol. 11. No. 7. pp. 593–594.

NUOVO ERCOLANI, 1918. Oct. 15–31. Vol. 23. Nos. 19–20. pp. 252–253.—La peste bovina in Italia. [Rinderpest in Italy.]

A small outbreak of rinderpest is stated to have occurred among cattle belonging to the civilian population just behind the fighting lines in Italy. It was soon eradicated by the prompt action of the authorities.

MORI (Nello). Afta epizootica in una mandra di bufalotti. Alcune considerazioni sulle origine del contagio. [Foot and Mouth Disease in a Herd of Buffaloes.]—*Clinica Vet.*, 1918. July 15. Vol. 41. No. 13. pp. 358–364.

PAUL (Gustav). Ueber Mischinfektionen auf der Kaninchenhornhaut bei der experimentellen Pockenepitheliose. [Mixed Infections on Rabbit Cornea in Experimental Variolar Keratitis.]—*Cent. f. Bakt.* 1. Abt. Orig., 1918. Jan. 31. Vol. 80. No. 6. pp. 361–370. With 17 text figs.

SCHEIBER. Beitrag zur Kenntnis der infektiösen Anämie. [Equine Infectious Anaemia.]—*Berliner Tier. Woch.*, 1918. July 11. Vol. 34. No. 28. pp. 271–274.

The author describes a number of cases of this disease among German horses on the Western Front in April 1918.

VELU. La variole des porcelets. [Variola of Young Pigs.]—*Rev. Gén. Méd. Vét.*, 1918. Apr. 15—May 15. Vol. 27. Nos. 316–317. pp. 136–145. With 4 text figs.

The substance of the above article has already been extracted in this *Bulletin* (1916. Vol. 4. No. 3. p. 115–117) from a series of articles that appeared in another journal.

WINCKEL (Ch. W. F.). Hondedolheid in Nederl.-Indië. [Rabies in Dutch East Indies.]—Koloniaal Instituut te Amsterdam. Mededeel. No. 11. Afdeel. Trop. Hyg. No. 6. pp. 45. 1918. Amsterdam: J. H. de Bussy.

BACTERIAL DISEASES.

BELIN (M.). Des lymphangites contagieuses du cheval.—A : Nouvelle terminologie.—B : Contribution à l'étude du traitement par la pyothérapie. [Contagious Equine Lymphangites.—A : New Terminology.—B : Treatment by means of Pyotherapy.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. May 2. *Rec. Méd. Vét.*, 1918. May 30. Vol. 94. No. 10. pp. 243–251.

CARPANO (Matteo). Contributo alle conoscenze dell'infezione morvosa nei felini (*Felis leo, Felis tigris, Felis domestica*). Associazione *B. mallei=B. felisepticum*. [Studies on Glanders Infections in the Lion, Tiger, and Cat. Association of the Glanders Bacillus with *B. felisepticum*.]—*Ann. d'Igiene*, 1918. Feb. 28. Mar. 31. Apr. 30. Vol. 28. Nos. 2, 3, 4, pp 68–75 ; 138–148 ; 183–191. With 1 plate & 2 charts.

DUPORT (O.). Bacillo de Preisz-Nocard. [Bacillus of Preisz-Nocard.]—*Rev. Vet. e Zootechnia*, 1918. Vol. 9. No. 1. pp. 29–32.

HINES (A. J.). Notes on Treatment of Ulcerative Lymphangitis from Nov. 18, 1917 to Jan. 11, 1918.—*Vet. Jl.*, 1918. June. Vol. 74. No. 6. pp. 199–202.

RUSS (Viktor K.) & TRAWIŃSKI (Alfred). Ueber das Vorkommen von Bakterien der Coli-Typhusgruppe im Pferdemist. [The Presence of Bacteria of the Coli-Typhoid Group in Horse Dung.]—*Ztschr. f. Hyg. u Infektionskr.*, 1918. Feb. 1. Vol. 85. No. 1. pp. 33–102. With 18 text figs. & 30 tables.

Out of 1,000 samples of horse faeces examined 77 strains were cultivated which resembled *B. paratyphosus* B on the usual culture media. On more detailed study by sugar and agglutination tests they were found to differ widely among themselves and from all members of the so-called *B. paratyphosus* B. group.

VAN SACEGHEM (R.). Traitement de la Lymphangite ulcéreuse. [Treatment of Ulcerative Lymphangitis.]—*Bull. Soc. Path. Exot.*, 1918. Oct. Vol. 11. No. 8. pp. 683–685.

"Pyo- and leucocyto-therapy bring about recoveries but do not set up immunity against the disease. . . . Experiments are now in progress to test the value of vaccination with living bacteria from the lesions and it is hoped by this means to obtain immunisation against the affection."

SCHREIBER (O.) & STICKDORN (W.). Zur aktiven Immunisierung gegen die Geflügelcholera. [Active immunisation against Fowl Cholera.]—*Berliner Tier. Woch.*, 1918. Oct. 10. Vol. 34. No. 41. pp. 401–402.

SZÁSZ (Alfred). Schutz-und Heilimpfung der Schweine gegen Milzbrand. [Prophylactic and Curative Inoculation of Pigs against Anthrax.]—*Ztschr. f. Infektionskr. . . . . d. Haustiere*, 1918. Sept. Vol. 19. No. 4. pp. 367–374.

——. Kann man die Rinder gegen Milzbrand und Rauschbrand gleichzeitig (simultan) impfen? [Can Cattle be Inoculated Simultaneously against Anthrax and Blackquarter.]—*Ztschr. f. Infektionskr. . . . . d. Haustiere.*, 1918. Sept. Vol. 19. No. 4. pp. 375–383.

THOMAS (M.). Contribution à l'étude des lymphangites ulcereuses par la pyothérapie. [Treatment of Ulcerative Lymphangitis by Pyotherapy.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. June 20. *Rec. Méd. Vét.*, 1918. June. 30. Vol. 94. No. 12. pp. 292–296.

TRAWIŃSKI (Alfred). Zur Morphologie und Biologie des *Bacillus suipestifer*. [Morphology and Biology of *B. suipestifer*.]—*Cent. f. Bakt.*, 1. Abt. Orig., 1918. Jan. 31. Vol. 80. No. 6. pp. 339–349. With 1 text fig.

VELU. La septicémie contagieuse du porc au Maroc. [Contagious Septicaemia of the Pig in Morocco.]—*Rec. Méd. Vét.*, 1918. May 15. Vol. 94. No. 9. pp. 236–241.

The subject matter of this paper has already been extracted in this *Bulletin* (Vol. 6. No. 2. p. 126).

——. Au sujet des heureux effets de la pyothérapie non spécifique dans le traitement des lésions pyogènes. [The Good Results following Treatment of Suppurative Lesions by Non-Specific Pyotherapy.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. June 20. *Rec. Méd. Vét.*, 1918. June 30. Vol. 94. No. 12. pp. 289–292.

MISCELLANEOUS.

ALDIGÉ (E.) The Symptomatology of Poisoning from Snake Bite in Cattle. —Abstracted in *Vet. Record.*, 1918. July 20. Vol. 31. No. 1567. p. 17.

——. L'amélioration des bovidés du Sénégal et les Sociétés de prévoyance indigène. [Improvement of Cattle Breeding in Senegal and Native Aid Societies.]—*Annuaire des Études historiques et scientifiques de l'Afrique occidentale francaise, 1917.* Abstracted in *Rev. Gén. Méd. Vet.*, 1918. Aug. 15. Vol. 27. No. 320. pp. 389-390.

ALGERIE. Rapport sur le fonctionnement de l'Institut Pasteur d'Algerie en 1917.—20 pp. 1918. Alger: E. Pfister.

HORNBY (H. E.). The Normal Erythrocyte Count of East African Native Cattle.—*Vet. Jl.*, 1918. July. Vol. 74. No. 7. pp. 243-244.

One bull, 9·7 millions; two cows, 7·8 to 10 millions; one ox, 9·6 millions; three young stock, 8 to 11·2 millions; five calves, 9·5 to 15 millions per cubic millimeter.

KOEVES (J.). Rauschbrand- und Bradsot-ähnliche Krankheit der Schweine. [Blackquarter and Bradsot-like Disease of Pigs.]—*Cent. f. Bakt.*, 1. Abt. Orig, 1917. Aug. 30. Vol. 80. No. 1/3, pp. 40–65. With 5 plates.

MASSINI (P. C.). Instituto Biológico de la Sociedad Rural Argentina. Resúmen de los Trabajos efectuados durante el Año 1917. [Summary of the Work done in 1917 at the Biological Institute of the Rural Society of Argentina.]—*Anales Soc. Rural Argentina*, 1918. Mar. Vol. 52. No. 3. pp. 141–147.

"In the report of the Parasitological Section, it is stated that a complete anatomical and histological study has been made of ticks in all stages of development and that this is being used as a basis for the experiments now being conducted with cattle and equines."—*Rev. App. Entom.*, Ser. B, 1918. Sept. Vol. 6. Part 9. p. 180.

MOUQUET. Autopsie d'hippopotame. Considérations diverses. [Post-mortem Examination of the Hippopotamus.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. June 6. *Rec. Méd. Vét.*, 1918. June 30. Vol. 94. No. 12. pp. 266–272. With 2 text figs.

NEIVA (Arthur) & PENNA (Belisario). Viajem cientifica pelo Norte da Bahia, Sudoeste de Pernambuco, Sul do Piauhé e de Norte a Sul de Goiaz. [A Scientific Journey through the North of Bahia, South-east of Pernambuco, South of Piauhy and from the North to the South of Goyaz.]—*Mem. Inst. Oswaldo Cruz.*, 1916. Vol. 8. No. 3. pp. 74–224. With 28 plates & 1 map.

OSBORNE (Thomas B.) & MENDEL (Lafayette B.). The Food Value of Soy Bean Products.—*Proc. Soc. Experim. Biol. & Med.*, 1917. May 16. Vol. 14. No. 8. pp. 174–175.

PÉRUSSET. Contribution à l'étude de l'agalactie contagieuse des chèvres et des moutons. [Contagious Agalaxy of Goats and Sheep.]—*Schweizer Arch. f. Tierheilk.*, 1918. Sept. Vol. 60. No. 9. pp. 403–412. With 12 text figs.

ROSSAS (José Francisco). Contribuiçao para o estudo da epizootia reinante no Estado do Espirito Santo. [Study of an Outbreak in the State of Espirito Santo, Brazil.]—*Rev. Vet. e. Zootechnia*, 1917. Vol. 8. No. 2. pp. 46–48.

SANFELICE (Francesco). Recherches sur la genèse des corpuscles du Molluscum contagiosum. [Researches on the Origin of the Corpuscles in Molluscum contagium.]—*Ann. Inst. Pasteur* 1918. Aug. Vol. 32. No. 8. pp. 363–373. With 1 coloured plate comprising 18 figs.

SCHMIEDHOFFER (Julius). Zur Ätiologie der Schweinediphtherie. [Etiology of Swine Diphtheria.]—*Ztschr. f. Infektionskr. . . . . d. Haustiere.* 1918. Sept. Vol. 19. No. 4. pp. 345–366. With 3 text figs.

SELLARDS (Andrew Watson) & BAETJER (Walter Albert). The Clinical Significance of the Irregular Distribution of Various Cells and Parasites in the Blood Stream and the Production of Abortive Leukaemic Changes and of Splenomegaly in the *Macacus rhesus*.—*Johns Hopkins Hosp. Bull.*, 1918. June. Vol. 29. No. 328. pp. 134–141. With 1 plate.

DE VASCONCELLOS (Aleixo). Nova materia corante para substituir a solução de Giemsa (Azurol). [New Giemsa substitute (Azurol).]—*Rev. Vet. e Zootechnia*, 1917. Vol. 8. No. 2. pp. 42–45.

WYSSMANN (E.). Weitere Mitteilungen über die Atoxyltherapie des bösartigen Katarrhalfiebers. [Further Reports on the Atoxyl Treatment of Malignant Catarrhal Fever.]—*Schweizer Arch. f. Tierheilk.*, 1918. May. Vol. 60. No. 5. pp. 189–215.